

REPORT

OF THE

MEDICAL SERVICES, MINISTRY OF HEALTH
SUDAN GOVERNMENT

FOR THE YEAR

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CHAPTER I.

INTRODUCTION.

The year saw the establishment of a Ministry of Health and the appointment of a Minister of Health responsible to the Legislative Assembly for the health of the country. The title Sudan Medical Service was substituted by that of Medical Services, Ministry of Health.

In common with much of the rest of the world Medical Services in the Sudan were handicapped by shortage of staff and difficulty in obtaining building materials, transport and equipment.

Expansion of medical services was represented by one new female ward, eleven new dispensaries and four dressing stations. Considerable improvement in housing for medical staff was effected.

CHAPTER II.

ADMINISTRATION.

(a) STAFF AND FUNCTIONS.

The Ministry of Health is responsible for the provision of medical and public health services throughout the country. In the municipalities of Khartoum, Khartoum North and Omdurman one Medical Officer of Health and one Assistant Medical Officer of Health are seconded to the service of the three local authorities. In other provinces the functions of Medical Officer of Health are carried out by the Province Medical Inspector, a central government servant.

Public health inspector staff is usually seconded to larger local government authorities. Such authorities undertake responsibility for much of the public health work in their areas, but mosquito control remains a central government commitment.

Seconded staff are liable to posting and transfer by the Ministry and are eligible for promotion within the appropriate cadres of the Ministry.

The Director of Medical Services is responsible for the administration and organisation of medical and health services. The headquarters of Medical Services are divided into Hospitals, Public Health and Laboratory branches, each in charge of an assistant director. In each province and in the Red Sea area of Port Sudan a Province Medical Inspector is responsible for all medical and health services of the province.

Table 1 shows the establishment and staff of classified and certificated officials of Medical Services at 31.12.1949.

TABLE I.

*Staff of Ministry of Health: Establishment of Classified
or Certificated Officials.*

CATEGORY	Establishment		
	British	Sudanese	Others
HEADQUARTERS.			
Director	1	—	—
Asst. Director (Public Health)	1	—	—
Asst. Director (Hospitals)	1	—	—
D.A.D. (Quarantine)	—	1	—
Controller of Medical Stores	1	—	—
Principal Matron	1	—	—
Superintendent	1	—	—
Chief Public Health Inspector	1	—	—
Principal, School of Hygiene and Asst. Chief Public Health Inspector	1	—	—
Head Staff Clerk	—	1	—
Staff Clerk	—	2	—
Clerk	—	23	—
Head Accountant	—	—	1
Accountant	—	2	—
Bookkeepers	—	21	—
Supt. of Stores	1	—	—
Asst. Supt. of Stores	—	—	1
Store Supervisor	—	3	—
Storekeeper	—	17	—
HOSPITALS AND DISPENSARIES.			
Director, Khartoum Civil Hospital and Senior Physician	1	—	—
Senior Surgeon	1	—	—
Gynaecologist	1	—	—
Ophthalmologist	—	1	—
Medical Inspector	23	20	—
Dental Surgeon (Contract)	1	—	—
Asst. Ophthalmologist	—	1	—
Radiographer	1	—	—
Pharmaceutical Registrar	—	—	1
Medical Registrar	—	1	—
Surgical Registrar	—	1	—
Lady Doctor	1	—	—
Obstetrical Registrar	—	1	—
Medical Officer	—	74	—
Medical Officer (Special Duties)	6	—	—
Housemen (recent graduates)	—	—	—
Medical Assistants	—	386	—
Matron, Khartoum Civil Hospital	1	—	—
Matron, Nurses School Omdurman	1	—	—
Charge Sister (Contract)	11	—	—
Nursing Sister (Contract)	17	—	—
Nurses (Certificated)	—	19	—
Staff Nurses	—	5	—
Dental Mechanic	1	—	—
Asst. Radiographer	—	9	—
Asst. Radiographer (Under training)	—	1	—
Pharmacist	—	1	—
Dispenser	—	14	—

CATEGORY	Establishment		
	British	Sudanese	Others
Dispenser (under training)	—	3	—
Bookkeeper	—	49	—
Southern Bookkeeper	—	1	—
Clerk	—	27	—
Southern Clerk	—	1	—
Hors Cadre Tutor (Scale.KI status)	—	1	—
Hors Cadre Southern Trainees (Class 1/11)	—	7	—
Storekeeper	—	16	—
Southern Storekeeper	—	—	—
Head Hospital Orderly Male	—	32	—
Theatre Attendant, Male	—	24	—
PUBLIC HEALTH.			
Medical Officer of Health, Khartoum.. .. .	1	—	—
Asst. Medical Officer of Health	—	1	—
Senior Public Health Inspector	3	—	—
Public Health Inspector	3	—	—
Public Health Officer	—	24	—
Sanitary Overseer.. .. .	—	125	—
Principal, M.T.S.	1	—	—
Charge Sister	1	—	—
Supervisor, Health Visitors	1	—	—
Clerk	—	5	—
Staff Midwife	—	8	—
Staff Health Visitor	—	2	—
Health Visitor	—	15	—
RESEARCH AND LABORATORY SERVICE.			
<i>Stack Medical Research Laboratories.</i>			
Asst. Director (Research)	1	—	—
Bacteriologist	1	—	—
Asst. Bacteriologist	—	1	—
Senior Lab. Assistant	1	—	—
Laboratory Assistant	3	36	—
Head Laboratory Attendant	—	1	—
Clerk	—	3	—
<i>Medical Entomology.</i>			
Medical Entomologist	1	—	—
Technical Assistant	—	3	—
Clerk	—	1	—
Aedes Control Officer	—	1	—
WELLCOME CHEMICAL LABORATORIES.			
Govt. Analyst (Senior Scientific Officer)	1	—	—
Chemist (Scientific Officer)	1	—	—
Senior Technical Assistant	—	2	—
Junior Technical Assistant	—	6	—
Clerk	—	1	—
KITCHENER SCHOOL OF MEDICINE.			
Dean	1	—	—
Library Clerk	—	1	—
GRAPHIC MUSEUM.			
Asst. Curator	—	1	—
Museum Attendant	—	2	—
	96	1,006	3

The unclassified employees (i.e. employees not on the establishment) number 4,200 approximately.

(b) **LEGISLATION.**

The following legislation affecting public health was enacted during the year :—

Ordinances

Date	Short Title	Provision
15. 6.49	The Workmens Compensation (Amendment) Ordinance, 1949	Amendment of Sec. 1. The Workmen's Compensation Ordinance, 1948, and Schedule of Disabilities.
31.12.49	The Workshops and Factories Ordinance, 1949.	For the safety and health of persons employed in Work-shops and Factories.

Regulations.

Date	Short Title	Provision
15. 6.49	The Quarantine (Yellow Fever) Amendment Regulations, 1949.	Amendment of the Quarantine (Yellow Fever) Regulations, 1945. Cancellation of Urgency Certificates.

Orders

Date	Short Title	Provision
15.6.1949	The Movement of Labourers Order, 1949.	Control of movement of gangs of labourers from province to province.
15.7.1949	The Khartoum Province (Size of Shops) Order, 1949.	Minimum size of shops in Khartoum.
15.7.1949	The Kassala Province. (Application) Amendment Order, 1949	Areas of building plots to be covered in Port Sudan.

(c) **FINANCE.**

Income and expenditure for the past four years are shown below :—

TABLE II (A)
*Income and Expenditure of Medical Services over the
Last Four Years.*

ITEM	1946	1947	1948	1949
	£E.	£E.	£E.	£E.
Revenue	70,537	68,775	54,393	42,279
Expenditure.				
Personnel and Personal Allowances	285,662	453,703	537,691	594,508
Services	296,450	340,841	348,891	414,245
Extraordinary	7,273	11,846	8,837	6,992
TOTALS	589,385	806,390	895,419	1,015,745

TABLE II (B)
Analysis of the Expenditure of Medical Services in 1949.

ITEM	Personnel	Services	Extra-ordinary	Total
	£E.	£E.	£E.	£E.
Headquarters	41,287	63,927	617	105,831
Hospitals and Dispensaries	429,360	310,422	5,620	745,402
Hygiene and Public Health	94,761	36,499	210	131,470
Research	26,221	3,397	—	29,618
Graphic Museum	600	—	—	600
Seconded Staff	2,279	—	545	2,824
TOTALS	594,508	414,245	6,992	1,015,745

CHAPTER III.
PUBLIC HEALTH.
(a) **HEALTH OF OFFICIALS.**

TABLE 3.

NATIONALITY		Number of officials employed	Total		Average days sickness		Died	Invn- lided
			Placed on sick list	No. of days sick	For all officials	For those who were sick		
British	1948 ..	918	189	1,623	1.77	8.59	—	5
	1949 ..	925	174	1,336	1.44	7.68	2	—
Sudanese	1948 ..	5,144	1,153	12,144	2.36	10.53	4	8
	1949 ..	5,492	1,295	13,612	2.48	10.51	9	11
Others	1948 ..	271	68	530	1.96	7.79	—	—
	1949 ..	243	78	726	3.39	9.30	1	2

(b) GENERAL HEALTH.

Table 4 below shows an almost uninterrupted increase in the numbers of admissions and outpatient attendances during the last ten years. It is probable that this increase is partly due to an increase of medical facilities and more to a growing public readiness to seek medical aid and that it does not represent an increase in the incidence of sickness. Estimates of population are not sufficiently precise to make it possible to relate increase of medical work to increase of population served.

TABLE 4 (a).

YEAR							Admissions	Attendances	Operations
1940	..	..	..	..	..	..	104,422	6,649,335	11,139
1941	..	..	..	..	..	..	103,023	6,330,711	10,417
1942	..	..	..	..	..	..	114,837	6,750,329	11,353
1943	..	..	..	..	..	..	112,275	6,796,372	12,726
1944	..	..	..	..	..	..	131,077	7,077,919	13,796
1945	..	..	..	..	..	..	131,571	7,897,148	15,455
1946	..	..	..	..	..	..	126,586	8,474,874	15,509
1947	..	..	..	..	..	..	142,294	9,253,251	16,785
1948	..	..	..	..	..	..	140,511	9,820,304	17,573
1949	..	..	..	..	..	..	151,011	10,186,668	21,327

TABLE 4 (b)

Year to year percentage increase/decrease for admissions, attendances and operations.

Increase/Decrease Percentage.

Year							Admissions	Attendances	Operations
1940	..	..	..	..	..	..	—	—	—
1941	..	..	..	..	..	..	— 1.3	— 4.8	— 6.5
1942	..	..	..	..	..	..	+ 11.5	+ 6.6	+ 8.9
1943	..	..	..	..	..	..	— 2.2	+ 0.7	+ 12.1
1944	..	..	..	..	..	..	+ 16.7	+ 4.1	+ 8.4
1945	..	..	..	..	..	..	+ 0.4	+ 11.6	+ 12.0
1946	..	..	..	..	..	..	— 3.8	+ 7.3	+ 0.3
1947	..	..	..	..	..	..	+ 12.4	+ 9.1	+ 8.2
1948	..	..	..	..	..	..	— 1.3	+ 6.1	+ 4.6
1949	..	..	..	..	..	..	+ 7.5	+ 3.7	+ 21.3

Over the ten year period the percentage increases are :

Admissions	..	..	..	44.6
Attendances	..	..	..	53.2
Operations	..	..	..	91.4

(c) **VITAL STATISTICS.**

The estimated population figures for the provinces are given in Table 5. Since a census of population has never been taken these figures must be accepted with considerable reserve.

TABLE 5.

Province	Estimated Population			
	Men	Women	Children	Total
Bahr el Ghazal	177,014	187,365	363,468	727,847
Blue Nile	464,573	545,298	762,195	1,772,066
Darfur	212,378	328,599	408,663	949,640
Equatoria	162,253	173,657	293,713	629,623
Kassala	228,259	213,968	295,558	737,785
Khartoum	119,487	109,542	166,970	395,999
Kordofan	392,609	494,399	762,121	1,649,129
Northern	156,884	228,320	305,402	690,606
Upper Nile	174,039	220,643	364,678	759,360
TOTAL	2,087,496	2,501,791	3,722,768	8,312,055

The estimated population of the Three Towns of Khartoum, Omdurman and Khartoum North is given in Table 6.

TABLE 6.

Town	Estimated Population			
	Men	Women	Children	Total
Khartoum	28,065	22,574	24,339	74,978
Omdurman	33,605	41,502	51,563	126,670
Khartoum North	11,746	10,070	15,487	37,303
TOTAL	73,416	74,146	91,389	238,951

Registration of births is probably fairly complete in the Three Towns. Registration of deaths is nowhere complete.

TABLE 7.

Number of registered births and birth rate.

Khartoum, Omdurman, Khartoum North.

Town	No. of Births	Birth rate per 1,000
Khartoum	1,645	22
Omdurman	2,899	23
Khartoum North	965	25

(d) PREVENTIVE MEDICINE.

1. Insect-borne Diseases.

Malaria. 14,360 cases were admitted to hospital; 210 deaths were attributed to the disease. Comparable figures in 1948 were 12,546 and 196. 219,226 cases attended at out-patient departments.

The type and distribution of parasite reported in 9,037 positive slides was :—

TABLE 8.

Province	<i>P. falciparum</i>	<i>P. vivax</i>	<i>P. malariae</i>
Bahr El Ghazal	1,253	9	1
Blue Nile	1,311	26	2
Darfur	498	24	—
Equatoria	1,543	270	217
Kassala	1,103	37	1
Khartoum	674	62	—
Kordofan	769	169	42
Northern.. .. .	705	96	2
Upper Nile	222	1	—
TOTAL	8,078	694	265

Table 9 shows, by provinces, the number of cases of malaria diagnosed in out-patient departments per 10,000 of estimated population and the number of cases of malaria expressed as a percentage of the total first attendances.

TABLE 9.

Province	Outpatient cases of malaria per 10,000 estimated population	Cases of malaria as percentage of the total first attendances
Bahr el Ghazal	960	7.3
Blue Nile	4,648	9.0
Darfur	1,113	4.8
Equatoria	2,208	3.6
Kassala	2,879	4.4
Khartoum	1,787	1.4
Kordofan	2,674	8.2
Northern	1,919	3.2
Upper Nile	2,597	11.8

These figures probably reflect as much the availability of medical resources and the willingness of the people to make use of them as the actual incidence of malaria in the respective areas.

In most urban areas larval control using 5 per cent D.D.T. in malariol was maintained. During the dry season larval control is an effective, but expensive, means of malaria prevention. It is far from being fully effective during the rains when suitable conditions for mosquito breeding may be widespread and often inaccessible.

D.D.T. in paraffin residual spray was used on a limited scale in most urban areas. General reports indicate that it was not found to be an effective method of mosquito control.

All dwellings in four blocks of the Gezira Irrigated Area were treated in June with a suspension of D.D.T. Wettable Powder. The results of the measure were judged only on the recorded incidence of malaria in the area concerned. The rainfall throughout the Gezira was abnormally low and the overall incidence of malaria was accordingly below average. This natural factor tended to make the results of the experiment inconclusive.

Blackwater Fever. Table 10 shows the recorded incidence of this disease in the past six years.

TABLE 10.

YEAR	Cases	Deaths
1944	11	4
1945	14	2
1946	14	3
1947	4	—
1948	12	5
1949	3	—

Relapsing Fever. The low incidence of this disease that followed the introduction of D.D.T. Anti-lice powder was sustained. This simple method of cleansing is popular and willingly sought for. The recorded incidence of the disease over ten years is shown in Table 11. The distribution of the disease in provinces during 1949 is shown in Table 12.

The infection is predominantly seen in Westerners. Those eastern provinces showing a relatively high incidence of relapsing fever have a large western population who are repeatedly subject to contact with new immigrants from the west.

TABLE 11.

Relapsing fever during the past ten years.

YEAR.	Cases	Deaths
1940	1,487	45
1941	3,028	110
1942	5,287	559
1943	10,505	668
1944	22,672	310
1945	17,392	444
1946	1,952	65
1947	568	67
1948	287	8
1949	376	3

TABLE 12.

*Relapsing fever, 1949.**Distribution by provinces.*

PROVINCE							Cases	Deaths
Blue Nile	..	..	..	..	..	..	128	1
Darfur	..	..	..	..	..	..	173	—
Kassala	..	..	..	..	..	..	56	2
Khartoum	..	..	..	..	..	..	3	—
Kordofan	..	..	..	..	..	..	16	—
							376	3

Leishmaniasis.

TABLE 13.

Leishmaniasis : Reported Incidence in past Ten Years.

YEAR							Cases
1940	..	..	..	..	..	..	460
1941	..	..	..	..	..	..	434
1942	..	..	..	..	..	..	432
1943	..	..	..	..	..	..	225
1944	..	..	..	..	..	..	205
1945	..	..	..	..	..	..	192
1946	..	..	..	..	..	..	246
1947	..	..	..	..	..	..	327
1948	..	..	..	..	..	..	460
1949	..	..	..	..	..	..	523

TABLE 14.

*Leishmaniasis, 1949.**Geographical distribution of cases and deaths.*

PROVINCE								Cases	Deaths
Blue Nile	..	..	..	..	..	..	..	129	19
Darfur	..	..	..	..	..	..	..	2	—
Equatoria	..	..	..	..	..	..	..	80	2
Kassala	..	..	..	..	..	..	..	262	54
Khartoum	..	..	..	..	..	..	..	8	1
Kordofan	..	..	..	..	..	..	..	9	3
Northern	..	..	..	..	..	..	..	1	—
Upper Nile	..	..	..	..	..	..	..	32	5
TOTALS								523	84

Trypanosomiasis. The only reported incidence of this disease was in Equatoria Province. 34 new cases, with one death, were discovered. 283,500 gland palpations and 3,953 gland punctures were made.

Sleeping sickness control has been in force since 1909. Control of movement and watering places was organised. Control of the vector was added in 1938.

Re-settlement in the Azande area in 1949 has made much of the old methods of control impracticable. Experience has suggested that the effectiveness of fly control is limited when the density of *G. palpalis* is low and the country well shaded.

Re-settlement without reclamation has multiplied the number of drinking places and increased the opportunity of fly-man contact. Clearings have become too expensive as so many are needed. Reclamation can only take place slowly in the conditions of Azande re-settlement and it is agricultural policy to conserve the forest of the stream heads and to avoid cultivation of river banks. However, in the re-settlement area both fly density and percentage of infection are low. In the past sleeping sickness inspections were carried out by senior medical staff at gatherings of whole tribes collected by the chiefs. In the re-settled areas it is now proposed that sleeping sickness inspections be undertaken by travelling medical assistants in the course of their other duties on tour. It is hoped that such tours undertaken regularly will enable the early cases of sleeping sickness to be diagnosed and treated and will keep the fly infection rate down to a minimum.

Accurate registers of population have been started in the re-settled areas and these should form a check on the completeness of travelling inspections. It is hoped that such inspections only will be an adequate control measure.

The revision of the registers in the re-settled areas during 1949 revealed that there has been a disturbing degree of absenteeism from inspections. The low incidence of reported cases during the year may be more due to evasion of inspection than to a real fall in the incidence of the disease.

Table 15 shows the number and distribution of cases of sleeping sickness discovered since 1940.

TABLE 15.
Area and Number of Cases

YEAR	Yubo	Yambio	Yei	Kajo-Kaji	Meridi	Imported	Other Localities.	TOTAL
1940	80	—	—	—	—	1	—	81
1941	69	—	—	1	47	8	—	125
1942	42	—	—	2	25	—	—	69
1943	60	—	8	1	9	3	—	81
1944	37	—	35	—	4	—	4	80
1945	16	1	19	—	—	—	3	39
1946	21	19	16	—	—	—	—	56
1947	18	6	21	—	2	—	—	47
1948	32	23	20	—	—	—	—	75
1949	5	12	17	—	—	—	—	34

*Filaria*s. 481 cases were reported, of which 438 were in Equatoria Province.

Typhus fever. No case was reported.

Yellow fever. No case was reported.

2. EPIDEMIC AND ENDEMIC DISEASES.

Cerebrospinal meningitis. There was a small epidemic in Wau, Bahr El Ghazal Province, in the early part of the year. Elsewhere the incidence was sporadic and, as is often the case in a sporadic distribution, the case fatality rate was disappointingly high. Table 16 shows the distribution of cases and deaths in 1949.

TABLE 16.

PROVINCE						Cases	Deaths
Bahr El Ghazal	..	..	..	..	..	127	26
Blue Nile	..	..	..	..	..	42	7
Darfur	..	..	..	..	..	12	4
Equatoria	..	..	..	..	..	121	37
Kassala	..	..	..	..	..	12	9
Khartoum	..	..	..	..	..	19	11
Kordofan	..	..	..	..	..	15	5
Northern	..	..	..	..	..	5	3
TOTAL						353	102

TABLE 17.

Reported incidence of cerebrospinal meningitis since 1940.

YEAR							Cases	Deaths
1940	..	..	..	..	..	..	4,032	796
1941	..	..	..	..	..	..	1,824	459
1942	..	..	..	..	..	..	2,787	1,027
1943	..	..	..	..	..	..	3,526	765
1944	..	..	..	..	..	..	2,346	405
1945	..	..	..	..	..	..	6,166	666
1946	..	..	..	..	..	..	730	155
1947	..	..	..	..	..	..	443	159
1948	..	..	..	..	..	..	170	59
1949	..	..	..	..	..	..	353	102

Diphtheria. The disease remained mildly endemic with the main distribution in urban areas. It was decided that the incidence of the disease is not high enough to justify the expense of routine immunisation of susceptibles, though this protection is available if requested.

TABLE 18.

Diphtheria : reported cases and deaths since 1940.

YEAR							Cases	Deaths
1940	..	..	..	..	..	..	114	8
1941	..	..	..	..	..	..	186	38
1942	..	..	..	..	..	..	207	33
1943	..	..	..	..	..	..	309	45
1944	..	..	..	..	..	..	270	61
1945	..	..	..	..	..	..	389	54
1946	..	..	..	..	..	..	390	61
1947	..	..	..	..	..	..	319	37
1948	..	..	..	..	..	..	326	27
1949	..	..	..	..	..	..	264	36

TABLE 19.
Diphtheria 1949.
Distribution of cases and deaths.

PROVINCE						Cases	Deaths
Blue Nile	..	..	..	..	..	62	13
Darfur	..	..	..	..	..	5	2
Equatoria	..	..	..	..	..	1	1
Kassala	..	..	..	..	..	34	7
Khartoum	..	..	..	..	..	109	5
Kordofan	..	..	..	..	..	27	3
Northern	..	..	..	..	..	26	5
TOTAL						264	36

Dysentery. 4,266 cases were admitted to hospital. There were 118 deaths. 38,776 cases were diagnosed in out-patient departments. Differentiation between amoebic and bacillary infections was not generally practicable and there was probably a tendency to include too many cases in the former group on a clinical diagnosis only.

Enteric fever. The mean recorded annual incidence over the past twelve years is 195.6 cases, with 116 cases in 1946 and 336 cases in 1940 as the extreme figures.

311 cases with 24 deaths were reported in 1949. The infection has long been endemic in Omdurman and in the past cases of the disease were largely restricted to urban centres. In recent years the distribution has become more widespread and the disease has become established in the Gezira Irrigated Area. During 1949 a total of 44 cases were admitted to Abu Usher hospital, which serves a large village population in the northern district of this area.

During the last months of the year minor epidemics occurred in Omdurman and in Kober village of Khartoum North. It was not possible to trace a common source of infection in any of the cases and it was probable that the spread was due to undetected carriers possibly through the medium of flies.

Inmates of the Central Prison in Kober, warders and their families were immunised with T.A.B. No case occurred in this institution.

Omdurman is largely served by pit latrines and these are frequently a source of fly breeding. The nuisance was considerably lessened by routine dusting of pit latrines with B.H.C. powder.

Table 20 shows the geographical distribution of cases and deaths.

TABLE 20.

PROVINCE						Cases	Deaths
Blue Nile	..	..	..	..	..	107	6
Darfur	..	..	..	..	..	19	1
Equatoria	..	..	..	..	..	25	2
Kassala	..	..	..	..	..	22	3
Khartoum	..	..	..	..	..	65	5
Kordofan	..	..	..	..	..	4	2
Northern	..	..	..	..	..	50	4
Upper Nile	..	..	..	..	..	19	1
TOTAL						311	24

Leprosy. In the Southern Sudan Leprosy surveys were combined with sleeping sickness inspections.

One B.E.L.R.A. lay worker was engaged in the Moru district of Equatoria.

As far as practicable active cases were segregated in partially self-supporting leper settlements. Table 21 shows the distribution of known cases of leprosy in 1949.

TABLE 21.

PROVINCE	Total known cases	Total in Settlements		Bacteriologically positive new cases found during the year.
		Government	Missions	
Bahr El Ghazal	222	145	—	32
Blue Nile	191	45	—	31
Darfur	79	69	—	21
Equatoria	6,907	794	132	452
Kassala	54	31	—	12
Khartoum	51	—	8	13
Kordofan	2,103	104	—	16
Northern	7	1	—	5
Upper Nile	38	—	26	19
TOTAL	9,652	1,189	166	601

Rabies. 1313 persons were given prophylactic inoculations, a number on suspicion as it was often not possible to ascertain if the biting animal was rabid. In other instances it was impossible to be sure of the degree of contact with the rabid animal.

19 persons died of rabies. 4 of these received a full course of injections starting 1, 1,2 and 25 days respectively after the bite. The remainder received incomplete or no prophylaxis.

Smallpox. There was a small epidemic in Darfur, the disease being introduced by pilgrims from West Africa. A quarantine station, through which 12,618 West Africans passed, was established at Asunga, near Geneina. 8 cases of smallpox were detected in the station. A vaccination campaign was undertaken in the Dar Masalit.

A mild form of the disease, diagnosed as alastrim, smouldered in the Upper Nile Province. The disease in this form is not feared by the people and the actual number of cases must remain conjectural.

524,693 vaccinations were performed throughout the country during the year.

The distribution of cases and deaths is given in Table 22.

TABLE 22.

PROVINCE							Cases	Deaths
Bahr El Ghazal	..	..	..	..	..	..	9	—
Blue Nile	..	..	..	..	..	..	41	5
Darfur	..	..	..	..	..	..	132	8
Khartoum	..	..	..	..	..	..	1	—
Kordofan	..	..	..	..	..	..	25	—
Upper Nile	..	..	..	..	..	..	38	—
TOTAL						..	246	13

TABLE 23.

Number of cases and deaths from smallpox recorded since 1940.

YEAR							Cases	Deaths
1940	..	..	..	..	..	..	515	104
1941	..	..	..	..	..	..	46	—
1942	..	..	..	..	..	..	12	—
1943	..	..	..	..	..	..	182	36
1944	..	..	..	..	..	..	242	51
1945	..	..	..	..	..	..	—	—
1946	..	..	..	..	..	..	—	—
1947	..	..	..	..	..	..	807	160
1948	..	..	..	..	..	..	—	—
1949	..	..	..	..	..	..	246	13

Tuberculosis. There has for years been a general upward trend in the number of cases of both pulmonary and non-pulmonary tuberculosis admitted to hospitals. The admissions to hospitals do not represent the full diagnosed incidence of the disease since, in general, cases unlikely to benefit from hospital treatment are referred for domiciliary supervision.

It is difficult to decide whether the increase in hospital admissions represents a real increase in the incidence of infection, or to what extent it is due to such incalculable factors as a greater readiness to seek medical aid, extension of medical services and improved methods of diagnosis.

The deaths recorded in cases admitted to hospital certainly do not reflect the true fatality rate of tuberculosis. The Sudanese as a rule are intolerant of prolonged detention in hospital and in this chronic disease large numbers of patients discharge themselves from hospital and probably die in their homes often far from any facilities for the accurate recording of cause of death.

Tuberculosis of cattle is very rare in the Sudan. Both pulmonary and all forms of non-pulmonary tuberculosis in humans are probably always due to the human organism and the source of infection in both is probably almost exclusively the open human case of tuberculosis. Apart from the social and economic factors which everywhere play so large a part in the genesis of human tuberculosis the control of the disease may be resolved into supervision of the open case and a system of case finding designed to detect early cases of infection.

Table 24 shows the number of cases of tuberculosis admitted to hospitals since 1940. Cases admitted to dispensaries, in which the diagnosis was made on clinical grounds only, and cases admitted to isolation institutions, many of which were transferred from general hospitals, are not included.

TABLE 24.

YEAR			Pulmonary	Non-Pulmonary	Total
1940	..	..	579	457	1,036
1941	..	..	631	511	1,142
1942	..	..	671	505	1,192
1943	..	..	593	529	1,122
1944	..	..	796	632	1,428
1945	..	..	957	643	1,600
1946	..	..	888	613	1,501
1947	..	..	877	599	1,476
1948	..	..	1,019	604	1,623
1949	..	..	1,176	650	1,826

Table 25 shows, by provinces, the incidence per 100,000 population of all cases of tuberculosis diagnosed in 1949. A considerable number of persons diagnosed and recorded in Khartoum Province had come from outside provinces in search of treatment.

TABLE 25.

Rate per 100,000 of estimated population.

PROVINCE							Pulmonary Tuberculosis	Non-Pulmonary Tuberculosis
Bahr El Ghazal	..	..	..	..	..	..	13.6	4.7
Blue Nile	..	..	..	..	..	..	35.3	21.7
Darfur	..	..	..	..	..	..	5.5	3.3
Equatoria	..	..	..	..	..	..	22.9	7.3
Kassala	..	..	..	..	..	..	58.0	44.3
Khartoum	..	..	..	..	..	..	89.9	84.1
Kordofan	..	..	..	..	..	..	8.6	6.8
Northern	..	..	..	..	..	..	44.9	17.5
Upper Nile	..	..	..	..	..	..	17.8	10.7

The disease was predominantly detected in persons of early and middle adult life. Cases in infancy and early youth were comparatively rarely seen. Table 26 shows the age distribution of cases of pulmonary and non-pulmonary tuberculosis admitted to hospital in the northern and southern Sudan.

TABLE 26.
Cases in age periods.

	0-1	1-5	6-15	16-25	26-35	36-45	46-65	Over 65
<i>Northern Sudan.</i>								
Pulmonary T.B. ..	—	1	16	217	47	197	128	29
Non-Pulmonary T.B. ..	3	32	65	96	145	77	46	37
<i>Southern Sudan.</i>								
Pulmonary T.B. ..	—	—	5	34	95	39	32	2
Non-Pulmonary T.B. ..	1	11	35	17	35	23	3	1
<i>West Africans.</i>								
Pulmonary T.B. ..	—	—	—	8	17	5	3	1
Non-Pulmonary T.B. ..	—	—	—	4	13	4	1	1

The site of the main lesion in 650 cases of non-pulmonary tuberculosis admitted to hospital is shown in Table 27.

TABLE 27.

Site of lesion										Number of cases
Gland	..	..	..	..	..	..	..	..	..	226
Bone	..	..	..	..	..	..	..	..	..	242
Joint	..	..	..	..	..	..	..	..	..	65
Others	..	..	..	..	..	..	..	..	..	117

There is no doubt that in more advanced areas there is an increasing degree of tuberculosis consciousness and a growing readiness to come forward for treatment. The overcoming of the stigma associated with the disease is an essential first step towards an adequate tuberculosis service. Unfortunately increasing sophistication is apt to be associated with a clamour for the use of streptomycin and there is a real risk that the unwise administration of this antibiotic may give rise to a widespread resistant strain of organism.

A start has been made towards the formation of a pilot tuberculosis service in Khartoum. The aims are to secure hospitalization of cases for the minimum effective period ; to build up an adequate scheme of domiciliary treatment and supervision ; to undertake the investigation and supervision of contacts of known cases.

Undulant fever. 52 cases were reported with one death. Cases occurred in every province except the Bahr El Ghazal.

3. HELMINTHIC DISEASES.

Ancylostomiasis. There was no marked change in the incidence of this disease, but a survey in Urbi district of Dongola revealed a high infection rate.

Progress was made in village sanitation in Equatoria province. In the Azande scheme resettlement areas each homestead has made a pit latrine.

Dracontiasis. Table 28 shows the recorded incidence of the disease.

TABLE 28.

Province	Cases
Bahr el Ghazal	607
Blue Nile	84
Darfur	17
Equatoria	2,296
Kassala	66
Khartoum	10
Kordofan	343
Northern	58
Upper Nile	243
	<hr/> 3,724

(iii) *Schistosomiasis*.

Table 29 shows the percentage of persons found infected with *S. haematobium* and *S. Mansoni* in various provinces as a result of routine examinations of urine and stools.

TABLE 29.

Province	<i>S. haematobium</i>)		<i>S. Mansoni</i>	
	No. Examined	Percentage Infected	No. examined	Percentage Infected
Bahr el Ghazal	3,481	0.25	8,503	4.9
Blue Nile (Gezira)	81,027	8.9	81,027	8.8
Blue Nile (White Nile Reservoir)	16,731	5.8	5,211	1.8
Blue Nile (Fung))	6,000	3.7	4,786	1.3
Darfur	11,306	17.8	2,307	0.2
Equatoria	357	—	1,403	44.3
Kassala	15,803	3.2	11,354	0.45
Khartoum	36,892	1.7	33,708	0.30
Kordofan	23,907	22.8	7,031	0.39
Northern	44,239	6.5	4,554	0.97
Northern (Merowe and Dongola)	44,239	6.5	—	—
Northern (Wadi Halfa)	24,556	8.1	—	—
Upper Nile	6,389	2.5	3,256	1.9

With the exception of the figures quoted in the foregoing table for Blue Nile (Gezira), Blue Nile (White Nile reservoir), Northern (Merowe/Dongola) and Northern (Wadi Halfa), which are the results of random surveys, the remainder of cases examined are to an extent a selected sample. In many it is probable that some clinical indications turned the attention of medical staff to a routine examination of urine or stools.

There was some evidence that the rectal form of schistosomiasis has increased in the irrigated areas of the Blue Nile Province and both types of the disease present a serious public health problem.

Males generally showed a higher infection rate than females and the highest rate was found in boys of the age group 5 to 15 years.

A pilot control scheme has been started in that part of the Gezira under survey. The scheme was based on the assumption that a survey of the people, treatment of those found infected and sulphation of irrigation channels near villages where survey and treatment have been carried out, may help to break the cycle of infection. After variable periods a resurvey was made and further infected persons discovered were treated. In one group it was found that of 745 persons who had been treated only 80 were passing viable eggs after an average period of five months later. This result was regarded as encouraging and measures have been put in train with a view to extending the system of control throughout the Gezira Irrigated Area.

4. OTHER DISEASES.

Acute Rheumatism.

460 cases were admitted, with one death, compared with 203 cases and one death in 1948.

Neoplasms.

456 malignant and 4,432 benign tumours were recorded. Admissions to hospital were 266, with 38 deaths, and 406 with nine deaths, respectively. A classification of neoplasms submitted for pathological examination is included in the report of the Stack Medical Research Laboratories.

Venereal Diseases.

There is no indication of any change in the incidence of these conditions.

Yaws.

Two cases were diagnosed in Khartoum, but the disease was practically confined to the humid climate of the three southern provinces.

E. SANITARY CIRCUMSTANCES.

Water Supplies Urban.

Routine bacteriological examinations of piped water supplies were carried out and advice on purification techniques given based on the results obtained.

A piped supply to El Obied from deep bores at Banu, some four mile south of the town, was the first stage of a scheme to improve the water supply of the town.

Water Supplies Rural.

Progress was made in the increase of rural supplies by means of deep bores, mainly in Darfur, Kordofan and Kassala provinces. New "hafirs" (excavated rainwater reservoirs) were dug in these provinces. Hafirs demand careful protection if they are not to become sources of mosquito breeding and means of spread of schistosomiasis.

A number of chemical examinations were done to assess the potability of water from deep bores.

Disposal of Waste Matter.

Refuse. The introduction of six "Street Orderlies" in Khartoum proved a great success and the Council decided to increase the number.

An experiment in refuse disposal by controlled tipping in Port Sudan proved a failure.

There was a general tendency to regard a combination of mechanical and animal-drawn transport as the most efficient means of refuse collection and removal.

Night Soil. Further consideration was given to the plan to instal main drainage in Khartoum, but the estimated cost was regarded as beyond the resources of the municipality. A considerable number of septic tank plants were installed.

Extension of the septic tank system was made in Port Sudan.

Housing.

Great building activity was a feature of most of the main towns. In general the standard of building erected was better than in the past and there is little doubt that the Sudanese are coming to demand a higher standard of dwelling accommodation.

Much progress was made in the clearance of the insanitary areas of Khartoum Deims. This area has been replanned and largely rebuilt with a satisfactory standard of accommodation. A private latrine was made a necessary condition of approval of a new house and the long insoluble problem of sanitation in this area was nearly resolved.

Food in relation to health.

Inspection and control of foodstuffs was carried out in large towns. Standards for public restaurants, bakeries, mineral water factories, markets and shops were enforced at variable levels.

Except in the southern Fung district of the Blue Nile Province and the three southern provinces poor rains resulted in bad harvests and lack of grazing. In much of the northern Sudan three years of deficient rainfall led to a serious loss of animals and shortage of milk. The inhabitants were deprived of their main source of wealth and one of their most important foods and were unable to buy grain at the current high prices. Famine conditions existed in the Beja and Gedaref districts of Kassala province and in parts of Kordofan. Extensive relief measures minimised serious hardship.

A dietician engaged by the Ministry of Education was working on a survey of foodstuffs in the Gezira.

Industrial Hygiene.

The passage of the Factories and Workshops Ordinance, 1949, completed the new industrial legislation initiated by the passage of the Employers and Employed Persons Ordinance and the Workmens Compensation Ordinance in the previous year. This legislation emphasised the increasing importance of the hygiene of working conditions and signalled the advancement of industrialization in the Sudan.

CHAPTER IV.

SOCIAL HYGIENE.

1. MIDWIFERY.

420 government trained midwives were in practice at the end of the year. Their distribution throughout the country is shown in Table 30. The figures for Khartoum and Kordofan include staff midwives.

TABLE 30.

PROVINCE					Number of Midwives
Blue Nile	..	..	..	..	94
Darfur ..	..	..	..	..	21
Kassala	..	..	..	..	34
Khartoum	..	..	..	..	113
Kordofan	..	..	..	..	54
Northern	..	..	..	..	98
Upper Nile	..	..	..	..	6
					<hr/> 420 <hr/>

38 midwives completed training and were licensed to practise. Four of them represented the first output of El Obeid Midwives Training School. The newly licensed midwives returned to work in the provinces as shown in Table 31.

TABLE 31.

PROVINCE					Number of newly licensed midwives
Blue Nile	..	..	..	..	11
Darfur	..	..	..	..	4
Kassala	..	..	..	..	1
Khartoum	..	..	..	..	9
Kordofan	..	..	..	..	8
Northern	..	..	..	..	5
					<hr/> 38 <hr/>

2. MATERNITY AND CHILD WELFARE.

A health visitor service is of slow growth. It is difficult to find suitable staff to undergo the lengthy course of training necessary and there is a constant wastage rate of trained staff through marriage.

Attendance of ante-natal clinics is generally better than that at child welfare clinics.

The latter meet with the universal difficulties of persuading mothers that healthy children may benefit from supervision and advice and of dissuading mothers from regarding the centres as minor ailment clinics.

There was one British Supervisor of Health Visitors, who was also responsible for training. Eight Sudanese health visitors were working in Khartoum Province and there was one each in Port Sudan, El Obeid and Kosti. A British welfare worker and a Sudanese health visitor were seconded for work with the Ministry of Education.

In addition to the work done by health visitors, ante-natal centres were operating at the Midwives Training School, Omdurman and in connection with certain of the general hospitals and mission hospitals, but accurate figures of work done were not available from all centres. In the Khartoum Province there were 21,389 attendances at ante-natal centres, 18,184 at child welfare centres and 10,922 home visits were made.

3. SCHOOL HEALTH SERVICE.

Table 32 shows the results of medical inspection of school children.

TABLE 32.

Province and type of school.							Number examined	Conditions referred for treatment
Bahr el Ghazal.								
1	Secondary, boys	..	..	..	..	..	52	27
1	Intermediate, boys	..	..	..	..	..	64	41
11	Elementary, boys	..	..	..	..	..	1,252	722
1	Elementary, girls	..	..	..	..	..	50	27
1	Sub-grade, boys	..	..	..	..	..	37	28
Blue Nile (Wad Medani).								
1	Secondary, boys	..	..	..	..	..	575	159
3	Intermediate, boys	..	..	..	..	..	1,100	313
2	Intermediate, girls	..	..	..	..	..	500	100
17	Elementary, boys	..	..	..	..	..	3,924	1,079
3	Elementary, girls	..	..	..	..	..	360	177
Blue Nile (Sennar).								
8	Elementary, boys	..	..	..	..	..
1	Elementary, girls	..	..	..	..	..	1,061	541
							40	41
Blue Nile (Kosti).								
1	Intermediate, boys	..	..	..	..	..
5	Elementary, boys	..	..	..	..	..	159	170
5	Elementary girls	..	..	..	..	..	895	397
11	Sub-grade, boys	..	..	..	..	..	395	133
							866	672
Blue Nile (Dueim).								
1	Secondary, boys	..	..	..	..	..
1	Intermediate, boys	..	..	..	..	..	119	13
5	Elementary, boys	..	..	..	..	..	365	80
5	Elementary, girls	..	..	..	..	..	1,257	388
5	Sub-grade, boys	..	..	..	..	..	596	113
1	Sub-grade, girls	..	..	..	..	..	401	197
1	Khalwa	..	..	..	..	..	40	17
							45	50
Blue Nile (Singa).								
4	Elementary, boys	..	..	..	..	..
3	Elementary, girls	..	..	..	..	..	499	102
5	Sub-grade	..	..	..	..	..	423	45
							609	259

TABLE 32--(Contd.)

Province and type of school.							Number examined	Conditions referred for treatment
Blue Nile (Roseires).								
1	Elementary, boys	..	..	..	..	..	120	67
1	Elementary, girls	..	..	..	..	..	90	30
5	Sub-grade	..	..	..	..	..	238	157
Blue Nile (Northern Gezira).								
3	Intermediate, boys	..	..	..	..	..	425	190
11	Elementary, boys	..	..	..	..	..	2,027	773
7	Elementary, girls	..	..	..	..	..	938	350
26	Sub-grade	..	..	..	..	..	2,191	1,106
Darfur.								
1	Intermediate, boys	..	..	..	..	..	157	100
7	Elementary, boys	..	..	..	..	..	1,288	1,315
4	Elementary, girls	..	..	..	..	..	437	330
29	Sub-grade	..	..	..	..	..	1,509	593
7	Khalwas	..	..	..	..	..	322	389
Equatoria (Central).								
2	Mission	..	..	..	..	..	302	105
Equatoria (Yambio).								
1	Mission	..	..	..	..	..	176	121
Equatoria (Tambura).								
2	Mission	..	..	..	..	..	412	437
Equatoria (Meridi).								
1	Mission	..	..	..	..	..	132	298
Equatoria (Yei).								
1	Mission	..	..	..	..	..	288	435
Equatoria (Moru).								
3	Mission	..	..	..	..	..	97	21
Equatoria (Torit)								
1	Intermediate	..	..	..	..	..	173	122
3	Mission	..	..	..	..	..	524	343
13	Bush schools	..	..	..	..	..	585	190
Equatoria (Kapoeta).								
1	Mission	..	..	..	..	..	80	44
Kassala (Northern).								
5	Intermediate	..	..	..	..	..	335	67
8	Elementary, boys	..	..	..	..	..	966	183
4	Elementary girls	..	..	..	..	..	201	37
2	Sub-grade	..	..	..	..	..	204	36
Kassala (Southern).								
4	Intermediate	..	..	..	..	..	436	113
13	Elementary, boys	..	..	..	..	..	1,993	1,093
6	Elementary, girls	..	..	..	..	..	398	230
19	Sub-grade	..	..	..	..	..	1,016	549

TABLE 32—(Contd.)

Province and type of school.							Number examined	Conditions referred for treatment
Khartoum.								
8	Higher Schools	..	..	..	..	..	233	102
6	Secondary Schools, boys	..	..	..	..	..	1,045	472
2	Secondary, girls	..	..	..	..	..	114	65
14	Intermediate, boys	..	..	..	..	..	2,103	889
8	Intermediate, girls	..	..	..	..	..	513	405
2	Technical Schools	..	..	..	..	..	82	87
47	Elementary, boys	..	..	..	..	..	4,703	3,343
24	Elementary, girls	..	..	..	..	..	2,166	2,203
50	Khalwas	..	..	..	..	..	2,695	2,572
Kordofan (Centrál).								
3	Intermediate, boys	..	..	..	..	..	228	64
1	Intermediate, girls	..	..	..	..	..	104	14
	Elementary, boys	..	..	..	..	..	400	227
	Sub-grade	..	..	..	..	..	40	12
Kordofan (Eastern).								
	Elementary, boys	..	..	..	..	..	449	121
	Elementary, girls	..	..	..	..	..	203	22
	Sub-grade	..	..	..	..	..	242	90
Kordofan (Northern).								
	Elementary, boys	..	..	..	..	..	316	44
	Elementary, girls	..	..	..	..	..	107	8
	Sub-grade	..	..	..	..	..	154	44
Kordofan (Tegale).								
	Elementary, boys	..	..	..	..	..	305	227
	Elementary, girls	..	..	..	..	..	96	117
	Sub-grade	..	..	..	..	..	42	19
Kordofan (Jebels).								
	Mission Intermediate	..	..	..	..	..	67	35
	Teachers Training School	..	..	..	..	..	185	23
	Elementary, boys	..	..	..	..	..	1,688	1,129
	Sub-grade	..	..	..	..	..	897	787
Kordofan (Western).								
1	Intermediate, boys	..	..	..	..	..	78	23
	Elementary, boys	..	..	..	..	..	1,280	879
	Sub-grade	..	..	..	..	..	1,106	649
Northern (Atbara).								
1	Technical School	..	..	..	..	..	10	5
1	Intermediate, boys	..	..	..	..	..	186	25
9	Elementary, boys	..	..	..	..	..	1,730	488
2	Elementary, girls	..	..	..	..	..	236	60
13	Sub-grade	..	..	..	..	..	1,454	762
3	Khalwas	..	..	..	..	..	196	107
Northern (Halfa).								
2	Intermediate, boys	..	..	..	..	..	280	158
7	Elementary, boys	..	..	..	..	..	1,397	1,059
5	Elementary, girls	..	..	..	..	..	427	291
13	Khalwas	..	..	..	..	..	2,293	1,593

TABLE 32 —(*Contd.*)

Province and type of school.							Number examined	Conditions referred for treatment
Northern (Merowe).								
6	Elementary, boys	..	..	..	..	..	955	280
4	Elementary, girls	..	..	..	..	..	311	103
6	Sub-grade	..	..	..	..	..	661	314
19	Khalwas	..	..	..	..	..	1,211	494
Northern (Dongola).								
1	Intermediate, boys	..	..	..	..	..	166	125
1	Agricultural Training School	..	..	..	..	..	19	1
5	Elementary, boys	..	..	..	..	..	1,005	681
5	Elementary, girls	..	..	..	..	..	224	179
6	Sub-grade	..	..	..	..	..	555	469
2	Khalwas	..	..	..	..	..	346	290
Northern (Shendi).								
2	Intermediate, boys	..	..	..	..	..	280	154
2	Elementary, boys	..	..	..	..	..	401	38
1	Elementary, girls	..	..	..	..	..	103	22
Northern (Berber).								
2	Intermediate, boys	..	..	..	..	..	66	—
Upper Nile.								
2	Intermediate, boys	..	..	..	..	..	255	145
13	Elementary and Mission	..	..	..	..	..	1,026	791
1	Elementary, girls	..	..	..	..	..	123	103

4. HEALTH EDUCATION.

(a) The Graphic Museum in Khartoum has many exhibits designed to appeal to the lay mind. It attracted a considerable number of non-medical visitors.

(b) Health exhibitions were organised at a number of agricultural shows and other gatherings throughout the country. Material for such exhibitions was supplied from the Graphic Museum.

(c) The policy of supplying models illustrating elementary principles of hygiene to a number of rural dispensaries was continued.

(d) Lessons on hygiene, conducted by the teaching staff, were a part of the curriculum in all government schools.

(e) Articles on matters of health were published regularly in the Arabic press.

(f) A Sudanese "radio doctor" gave regular broadcast health talks. There was evidence that these talks attracted a wide audience.

(g) Health, and the responsibility of medical staff to undertake health teaching, has been increasingly stressed in the training of medical assistants and health visitors.

5. MENTAL HEALTH.

The Mental Diseases Board in Khartoum carried out 52 examinations on 45 cases. The Board advised on treatment, disposal and legal aspects.

A Sudanese specialist in mental diseases was posted to Khartoum North. There was ample evidence that his services are both useful and widely sought.

Plans were approved for an institution for the accommodation of persons of unsound mind detained under the provisions of the Code of Criminal Procedure.

CHAPTER V.

PORT HEALTH: QUARANTINES.

No seaport or airport was declared infected during the year.

The Aedes index at Port Sudan and Wadi Halfa during the year was nil.

Wadi Halfa area remained free of *A. gambiae*.

Disinfection of aircraft and quarantine control of air travellers were carried out at Wadi Halfa, Port Sudan, Khartoum, Malakal, Juba, Geneina, and El Fasher airports.

Port Sudan Quarantine.

932 ships entered Port Sudan compared with 765 in 1948.

446 sambuks entered Flamingo Bay compared with 707 in 1948.

42 ships arriving within six days of departure from suspected yellow fever ports were quarantined.

5,088 rats were caught, all identified as *R. rattus* and its sub-species. This figure does not include rats destroyed by poison. The rat flea index was 0.4.

Suakin Quarantine.

The number of pilgrims passing through Suakin quarantine was considerably less than in the preceding year. The figures for the past ten pilgrimage seasons are shown in Table 33.

TABLE 33.

SEASON	Number of Pilgrims
1940/41	2,085
1941/42	8,647
1942/43	7,670
1943/44	17,818
1944/45	6,999
1945/46	2,214
1946/47	8,404
1947/48	12,020
1948/49	11,105
1949/50	5,091

All pilgrims were vaccinated against smallpox and cholera before leaving the Sudan. The vaccines were made in the Stack Medical Research Laboratories.

The pilgrimage was declared "clean" and, initially, returning pilgrims were detained for only 24 hours at Suakin. However, certain of the returning pilgrims developed smallpox after arrival home and it transpired that cases of smallpox had

occurred in Jeddah. A fourteen day quarantine was imposed at Suakin, but no further cases of smallpox were discovered. The incidence of such cases of smallpox showed that the possession of valid Immunisation Certificate was not a complete protection against the disease.

As in past years a medical mission of two Sudanese doctors with ancillary staff and a small tented hospital accompanied the Sudanese pilgrims and provided facilities for their treatment and that of any other nationalities that cared to attend. The tented hospital was established near Jeddah and subsidiary treatment centres were formed at Mecca, Muna and Medina.

TABLE 34.

Medical Mission : Total Attendances, Admissions and Deaths.

Place	Total Attendances				Admissions				Deaths			
	Suda- nese	West Afr.	Others	Total	Suda- nese	West Afr.	Others	Total	Sud.	West Afr.	Others	Total
Jeddah	1,679	—	2,308	3,987	20	—	—	20	5	—	—	5
Mecca	1,346	—	840	2,186	4	—	—	4	4	—	—	4
Muna	224	54	68	346	—	—	—	—	1	—	—	1
Medina	770	—	409	1,179	12	—	—	12	4	—	—	4
TOTAL	4,019	54	3,625	7,698	36	—	—	36	14	—	—	14

Wadi Halfa Quarantine.

All travellers by rivercraft, except those in the first and second class, as well as those entering the Sudan by land were examined. 1,864 were admitted to the quarantine. 205 were found to be infected with schistosomiasis.

Geneina Quarantine.

A temporary quarantine was established at Asunga, near Geneina, when cases of smallpox were found amongst pilgrims entering the Sudan from French Equatorial Africa. 8 cases of smallpox were detected and detained in the quarantine.

CHAPTER VI.

HOSPITALS. DISPENSARIES.

OTHER UNITS.

Table 35 shows, by provinces, the number of hospitals and the number of beds available per 10,000 of estimated population at the end of 1949. The figures include mission hospitals.

TABLE 35.

Province	Number of Hospitals	Number of beds in hospitals	Number of beds in dispensaries	Total number of beds.	Number of beds per 10,000 of estimated population
Bahr El Ghazal ..	2	370	141	511	7.02
Blue Nile ..	7	1,109	67	1,176	6.64
Darfur	3	309	132	441	4.64
Equatoria ..	8	1,053	403	1,456	23.12
Kassala	4	722	149	871	11.94
Khartoum ..	7	958	22	980	23.75
Kordofan	5	646	530	1,176	7.13
Northern	6	666	6	672	9.73
Upper Nile ..	1	254	150	404	5.32

A dental surgeon was appointed and took up duties in Khartoum on 21.4.49. His work consisted mainly of treatment of officials and hospital patients and training of medical students and subordinate staff.

In Khartoum Province private dental surgeon practitioners were employed on a part time basis in the school medical service. They treated patients referred to them from the medical inspection of schools.

CHAPTER VII.

MEDICAL WORK OF MISSIONARY SOCIETIES.

Medical work done by missionary societies.

					Inpatients	Out-patients	Operations
CHURCH MISSIONARY SOCIETY.							
Omdurman (Khartoum Province)	..	..			1,596	36,609	230
Salara (Kordofan Province)	..	..	..		225	27,609	—
Katcha (Kordofan Province)	..	..	..		576	10,632	—
Ler (Upper Nile Province)	..	..	..		282	20,049	—
Lui (Equatoria Province)	..	..	..		835	139,615	592
AMERICAN MISSION.							
Nasir (Upper Nile Province)	..	..	..		107	42,299	—
Doleib hill (Upper Nile Province)	..	..	..		73	24,050	—
Wangel (Upper Nile Province)	..	..			—	5,019	—
SUDAN UNITED MISSION.							
Abri (Kordofan Province)	..	..	..		204	16,064	—
Moru (Kordofan Province)	..	..	..		605	2,779	—
Heiban (Kordofan Province)	..	..	..		356	18,249	—
Kauda (Kordofan Province)	..	..	..		—	7,909	—
SUDAN INTERIOR MISSION.							
Abaiyath (Upper Nile)	..	..	..	..	—	4,280	—
Doro	..	..	..	..		1,089	—
Banjang	..	..	..	..		2,805	—
					4,859	359,057	822

Nuns of the Verona Fathers' Mission worked as ward sisters in government hospitals at Juba and Wau.

CHAPTER VIII.

TRAINING OF MEDICAL STAFF.

1. THE KITCHENER SCHOOL OF MEDICINE.

The school was opened on 29th February, 1924. The 25th anniversary was celebrated on 11th March, 1949. The Minister of Health, El Sayed Dr. Ali Bedri, M.B.E., D.K.S.M., addressed a large gathering representative of all communities in the Three Towns and gave an account of the origin and development of the School.

During 1949 the following diplomates of the school were engaged in post-graduate study in the United Kingdom.

Dr. Dawood Iskander (1928) Obstetrics and Gynaecology.

Dr. Ibrahim Anis (1929) Tropical Medicine and Hygiene.

Dr. Hassan El Hakim (1929) Tropical Medicine and Hygiene.

Dr. Mansour Abdel Magid (1931) Tropical Medicine and Hygiene.

Dr. Mohammed Ahmed Ali (1933) Tropical Medicine and Hygiene.

Dr. Mohammed Zaki Mustafa (1933) Hospital Administration.

Dr. El Baghir Ibrahim (1936) Ophthalmology.

Dr. Anis Mohammed Ali (1943) Tropical Medicine and Hygiene.

Dr. Mohammed El Hassan Abu Bakr (1946) Tropical Medicine and Hygiene.

There were 27 students in the school during 1949, divided into classes as follow:-

Preclinical	..	..	..	..	..	12
Junior Clinical	..	..	..	..	..	11
Senior Clinical	..	..	..	..	..	4

Professional Examinations.

Organic Chemistry. Twelve candidates entered. Nine passed and three were referred for three months. The examiners were Mr. J. H. Pyle, B.Sc. and Mr. S. Thorburn, B.Sc.

Pharmacology. Eleven candidates entered and all passed. The examiner was Dr. J. S. Aldridge, M.R.C.S., L.R.C.P.

Referred professional Examinations.

Anatomy. Two candidates entered and passed. The examiner was Dr. N. Slade, M.B., Ch.B.

Physiology. Two candidates entered and passed. The examiner was Dr. J. S. Aldridge, M.R.C.S., L.R.C.P.

Public Health. One candidate entered and passed. The examiner was Dr. H. M. Elliott, M.B., B.Ch., D.P.H.

Organic Chemistry. Three candidates entered and passed. The examiners were Mr. J. H. Pyle, B.Sc., and Mr. S. Thorburn, B.Sc.

Final Professional Examinations. The final examinations were held in January 1950. The following entered and were successful :—

Dr. Abdel Bari Mutwakil.

Dr. Lewis Abdu Tadros.

Dr. Osman Modawi.

Dr. Abdel Gader Ginawi.

The examiners were :—

Medicine—Dr. W. F. Townsend-Coles, M.D., M.R.C.P., D.C.H.

Surgery—Mr. Abdel Hamid Bayoumi, D.K.S.M., F.R.C.S., F.R.F.P.S.G.

Obstetrics and Gynaecology—Dr. N. Slade, M.B., Ch.B.

School Prizes.

The following prizes were awarded :—

Pharmacology Prize Fayiz Amin

Archibald Prize in Social Medicine Lewis Abdu Tadros

Jackson Prize in Medicine Abdel Bari Mutwakil

The Waterfield Prize in Surgery and the Jackson Prize in obstetrics and gynaecology were not awarded.

There were no entries for the King Farouk Prize in Ophthalmology.

The Visitor. The visitor from the Royal Colleges was Mr. P. H. Mitchiner, C.B., C.B.E., T.D., M.D., M.S., C.Ch. F.R.C.S. He supervised the final examination held in January 1950.

Health of students. The health of students was good throughout the year.

2. (a) THE SCHOOL OF HYGIENE, KHARTOUM.

Two candidates passed their final examination and were awarded the certificate of the Royal Sanitary Institute. They were posted to Medical Services as Public Health Officers.

Fourteen students were under training in the school.

(b) THE SCHOOL OF HYGIENE, JUBA.

Three candidates passed the Sanitary Overseers examination in January and were posted to Equatoria, Bahr el Ghazal and Upper Nile Provinces respectively.

Two candidates passed the examination at the end of the year.

Four students were admitted to the school in July.

3. MEDICAL ASSISTANTS.

The course in the Medical Assistants School at Omdurman was one year. 10 candidates passed their qualifying examination at the end of the year. 12 medical assistants attended a refresher course.

The course for southern medical assistants at Juba was three years. Six candidates passed the qualifying examination. There were a further 22 students under training in the following classes—

Third year	..	..	..	..	..	6
Second year	..	..	..	..	..	8
First year	..	..	..	..	..	8

4. LABORATORY ASSISTANTS.

One laboratory assistant was trained in the Stack Medical Research Laboratories.

There were four first year students under training at Juba Hospital.

5. DISPENSERS.

Seven students were under training in Khartoum Hospital.

6. NURSES' TRAINING SCHOOL.

There were 46 female nurses under training. Two probationers passed the final examination and were registered. 26 probationers were admitted, of whom 13 were discharged as unsuitable.

Training of male medical orderlies was done by medical and British nursing staff in hospitals.

CHAPTER IX.

LABORATORY SERVICES.

1. THE STACK MEDICAL RESEARCH LABORATORIES.

BY DR. R. KIRK.

RESEARCH.

During the year investigations have been continued on onchocerciasis and bilharzia, fairly extensive taxonomic studies on *Phlebotomus* have been undertaken, attempts have been made to cultivate the virus of rabies, an investigation into the effects of phenol on vaccine lymph has been carried out and a form of bronchopneumonia of unknown etiology, occurring in newly-born children has been studied. Summaries of these and other research activities will be found under the appropriate headings.

A team from the United States Naval Medical Research Unit in Cairo is investigating malarial and other parasites of mammals and birds in the Southern Sudan, with headquarters at Torit. Professor P. A. Buxton, of the London School of Tropical Medicine, and Dr. W. H. R. Lumsden, of the Virus Research Institute, Entebbe, both spent some time in the Sudan in connection with studies on tsetse flies and *Phlebotomus* respectively. Dr. R. Lewthwaite, Colonial Medical Research Service, visited the Laboratories as a guest in November and as he was able to provide up-to-date and authoritative information on various subjects, especially chloromycetin, this visit had a very stimulating effect.

ROUTINE AND EDUCATIONAL ACTIVITIES.

A summary of the routine work and examinations carried out during the year is appended to this report. The total number of examinations was 25,949, a slight reduction as compared with the figures of last year (26,695). This is due to the continued devolution of Kahn tests to the hospital laboratories and restriction, or elimination, of tests which appear non-essential.

Notable increases are seen in two items of the routine work this year, namely the number of water tests carried out and the quantities of antirabic vaccine issued.

A vast amount of routine work, not shown in this report, has been carried out in the hospital laboratories throughout the country by Scale K and J members of the laboratory service, trained in and generally supervised from the Stack Laboratories. The work of these hospital laboratories, though essentially restricted in its scope to simple routine tests, is an important item in maintaining the efficient functioning of the Medical and Health Services throughout the country.

As in previous years, teaching duties in the Medical School have made heavy demands on the time and energy of the laboratory staff. Owing to staff changes and illness the position was rather critical for several months of this year.

Staff Changes—Dr. J. D. Bates was appointed to the Laboratories as Pathologist on 8th November following the retirement of Dr. Horgan on 8th January.

One Sudanese Laboratory Assistant was trained in 1949, and one retired on pension, leaving the total at 42. The number of hospital laboratories is now 28, the same as last year. A more formal constitution has been drawn up for the Laboratory Assistants' School to conform with other training schools in the Service.

POST-MORTEMS.

14 were carried out in Khartoum Civil Hospital of which 10 were medico-legal and requested by the police. There is nothing to add to the remarks frequently made in previous reports on a very unsatisfactory situation as regards the practical instruction of medical students.

PATHOLOGICAL HISTOLOGY.

The total number of specimens received was 380 (excluding brains for rabies).

NEOPLASMS.

114 malignant neoplasms were received, of which the following table is a brief summary.

TABLE 37.

SITE.	Carcinoma	Sarcoma	Endothelioma	Melanoma	Mixed Tumours	TOTAL
Scalp	1	—	—	—	1	2
Face	3	1	—	—	—	4
Tongue	1	—	—	—	—	1
Mouth	2	—	—	—	1	3
Eye	1	1	—	1	—	3
Nose	4	1	—	—	—	5
Neck	3	—	1	—	—	4
Thyroid	1	—	—	—	—	1
Parotid	—	—	—	—	4	4
Chest	2	2	—	—	—	4
Axilla	3	—	—	—	—	3
Hand	—	2	1	—	—	3
Arm	—	2	1	—	—	3
Pelvis	1	1	—	—	—	2
Leg	3	1	—	1	1	6
Foot	1	—	1	3	—	5
Rectum & Anal Canal	6	—	—	—	—	6
Abdomen	5	2	—	—	1	8
Liver	6	—	—	—	—	6
Bladder	8	—	—	—	—	8
Groin	1	—	—	—	—	1
Penis	3	—	—	—	—	3
Testis	1	—	—	—	—	1
Ovary	3	—	—	—	—	3
Uterus	3	—	—	—	—	3
Vagina	—	1	—	—	—	1
Breast	12	1	—	—	—	13
Lymphatic Glands ..	4	1	—	—	—	5
Skin (site unspecified)	2	—	—	1	—	3
TOTAL	80	16	4	6	8	114

RABIES.

214 brains were received, of which 13 were decomposed and useless for examination. 75 were positive for Negri bodies, including 59 dogs, 6 donkeys, 3 cats, 2 cows, 2 sheep, 2 goats and one hyaena. The 126 negatives include 4 monkeys, 2 hyaenas, one leopard and one duiker.

Rabies Vaccine.—124,200 c.cs. were issued in 1949, sufficient to treat 1,774 cases. This is a notable increase over the quantities issued in previous years. It suggests a great increase in the numbers of people coming for prophylactic treatment after having been bitten.

On the other hand it may represent merely an indication of the great waste of vaccine which is, perhaps, inevitable in a decentralised forms of antirabic treatment.

Immunizing Potency of the Vaccine.—Many authorities are sceptical about the value of antirabic vaccination, and Webster (1939) found great variations in phenolized vaccines from different manufacturers in the U.S.A., many being apparently completely devoid of immunizing power. Rabies vaccines marketed in the United States for use in human beings must now be tested for immunizing potency according to a method developed by the U. S. Public Health Service (Habel, 1940) by parallel intracerebral titrations of fixed virus in vaccinated and unvaccinated mice. In a standard test of this type, carried out in Khartoum, mice vaccinated with locally prepared (Semple) vaccine showed an end point titre of over 10,000 LD 50 less than that in unvaccinated controls, which indicates that the immunizing potency of the vaccine is satisfactory.

Attempts to Cultivate Rabies Virus in a cell-free medium.—Veeraraghavan (*Ind. J. Med. Res.*, 1946, 1947) claims to have demonstrated the multiplication of rabies virus in a cell-free culture medium containing various growth-promoting factors, principally amino-acids and vitamins. Estimating virus content by MLD titrations in guinea-pigs he concludes that the concentration of virus after 24 hours incubation at 37°C may reach approximately 3,300 times that ordinarily found in the brains of sheep used for the manufacture of antirabic vaccine. These observations, if confirmed, indicate the possibility of preparing a culture vaccine in which relatively enormous quantities of antigen (virus material) can be administered in small bulk with reasonable assurance that the immunity required to prevent rabies can be produced so rapidly as to reduce the risks of this disease to negligible proportions after an infective bite. Attempts were therefore made to repeat the Indian observations in Khartoum.

The technique described by Veeraraghavan (1947) was followed closely, except that shaking with glass beads was employed for making the virus emulsion instead of a Waring blender, the latter not being available. Also the MLD titrations were done in mice, according to standard methods, and not in guinea-pigs. The experiment was repeated several times, and analysis of the results by the method of Reed and Muench (*Amer. J. Hyg.* 1938) failed to demonstrate any increase in MLD titre after 24 hours culture. The results have been published in detail elsewhere (Kirk, Haseeb and Davis, *J. Trop. Med. & Hyg.*, 1950, in the press).

VACCINIA.

Routine preparation of vaccine lymph.—66 sheep were used for the production of 3585 grams of pulp with an average yield of 54.3 grams per sheep.

Research. Experiments were carried out to test the action of phenol in the purification of vaccine lymph. Five batches were prepared and each divided into two halves; one half was glycerinated and the other half was treated with phenol according to McClean's method (Lancet, September 10, 1949, p.476). Potency and bacteriological tests have been carried out over a period of nine months, during which no deterioration in potency has been observed. The reduction in bacterial count was of such a degree as to allow the issue of the vaccine a fortnight after tituration. The final dilution of phenol used was 0.4 per cent.

ONCHOCERCIASIS.

The work on onchocerciasis initiated in 1946 was continued this year, mainly by Mr. Lewis who has studied the development of the parasite in *Simulium damnosum*, the only vector of any importance in the Bahr el Ghazal, and accumulated a great deal of valuable information on the entomological aspects of the disease. Details will be found in the report on Medical Entomology. The recognition of peritrophic membrane in *Simulium damnosum* is of great scientific interest. Unfortunately in the conditions existing in the Bahr el Ghazal the prospects of reducing the incidence of this disease by control of the insect vector appear discouraging.

Studies in the chemotherapy of onchocerciasis with antrypol, mentioned in last year's report, have not been continued, as the drug proved extremely toxic, although it is undoubtedly filaricidal. A limited supply of hetrazan became available in 1949 and a few cases have been treated with this drug by Dr. Satti in Wau. The number of cases is small and it is too early to assess the final results, but disappearance of microfilariae, as estimated by skin snips, has been observed. Some moderately severe reactions have been noted, and this is of some interest. As hetrazan is relatively non-toxic in normal persons it is concluded that the reactions must be due to toxic substances liberated by worms which have been damaged by the drug, a point of considerable academic interest in connection with the mechanism by which symptoms are produced in onchocerciasis.

SCHISTOSOMIASIS.

Interesting specimens were submitted by Dr. Daoud Mustafa from a case of *S. mansoni* infection. The patient was admitted to Medani hospital on 14.9.1949 with acute dysenteric symptoms and ova of *S. mansoni* in the stool. He died five days later and at autopsy the whole length of the peritoneal surface of the small intestine was studded with little nodules resembling miliary tubercles. The mesenteric glands were moderately but universally enlarged and some were haemorrhagic. The parietal peritoneum was devoid of nodules, so also was the outer surface of most of the large bowel, only a few being seen in the lower portion. The liver was cirrhotic. The inner surface of the small intestine was congested with minute submucous haemorrhages, but showed no ulceration or overgrowth; The lower part of the large intestine was thickened and showed submucous haemorrhages and tiny scattered ulcers. Scrapings from the nodules on the intestinal outer surface showed very many *S. Mansoni* ova, as did also the mesenteric glands in paraffin sections and on digestion with sodium hydroxide. The pathology in this case suggests that of Far Eastern schistosomiasis, due to *S. japonicum*, rather than typical *S. mansoni* infection and illustrates the view recently stated by Faust (194) that the localisation of the different schistosomes is not always as specific as indicated in the text-books.

Antigenic tests. Dr. R. Forgan, Medical Consultant, May and Baker Ltd., kindly provided a supply of dried adult schistosomes which had been recovered from experimental animals, and antigen for intradermal tests was prepared from these. The worms were minced by grinding with broken glass to make a 1:1,000 suspension in 0.3 per cent carbol saline which was allowed to settle and the supernatant fluid bottled as antigen for intradermal tests. Preliminary tests indicate this antigen to be at least as sensitive as a sample of cercarial antigen kindly supplied by the Schistosomiasis Research Laboratory in Salisbury, Southern Rhodesia, and there has been no indication that it is less specific.

A number of cases of hepato-splenomegaly of unknown cause in which the ordinary routine tests had failed to reveal bilharzia infection were tested with this antigen and most of them gave a completely negative result. Several years ago the writer observed similar results on testing cases of hepato-splenomegaly for which no cause could be found with a bilharzial antigen prepared by Sir Robert Archibald from adult worms of *Schistosoma bovis*. It may be concluded that in at least some of the cases of hepato-splenomegaly of unknown etiology commonly encountered in the Sudan bilharzia is not the explanation.

Nilodin. Brigadier J. S. K. Boyd, Director of the Wellcome Laboratories of Tropical Medicine kindly placed at our disposal a limited supply of milodin (equivalent to the German preparation miracil) for clinical trial in schistosomiasis. So far some 16 cases have been treated with this drug, mostly by Dr. W. H. Greany in Medani who reports that disappearance of ova after treatment has been noted in some cases but it is too early yet to say whether this indicates cure or merely a temporary improvement. Others are still passing viable ova, varying periods after the completion of courses of treatment with total dosage similar to or greater than that recommended by the workers in Southern Rhodesia. It is not yet possible to assess the final results of treatment.

Nausea and vomiting are apt to be troublesome side effects with doses greater than 15 mgm. per kilo body weight (in contradistinction to those used by the Rhodesian workers the tablets supplied to us were not sugar-coated). Some individuals appear completely intolerant even with ordinary doses. In 4 cases of *S. haematobium* infection restricted apparently to the urinary system and studied by Dr. Mansour Ali Haseeb in Khartoum, the treatment was not successful. 3 cases proved intolerant and treatment had to be stopped after three days owing to severe vomiting and nausea with rapid loss of weight; three months later a second attempt to treat one of these cases produced exactly the same result. The fourth patient was a little girl who had three courses of 17 mgm kilo daily in divided doses for 6 days separated by rest periods of about four weeks. The drug was well-tolerated, but during the whole period of treatment (12 weeks) the patient continued to pass viable ova, and is still doing so, 30 days after the completion of this relatively prolonged treatment.

SANDFLIES.

Work on *Phlebotomus* has been continued mainly on taxonomic lines this year. A paper on the zoogeography of the Ethiopian species has been published, two new species and one new variety have been described from material sent to us from East Africa, and a revision of some of the groups is in progress. We are indebted to the Keeper of Entomology for access to the collections in the British Museum (Natural History) and to Mr. Paul Freeman, Professor Buxton and Dr. L. Parrot for their co-operation and advice.

PNEUMONIC DISEASE OF UNKNOWN ORIGIN IN NEWLY-BORN CHILDREN.

Attention has been directed during the past two years to a series of deaths in newly-born children in Khartoum Civil Hospital, restricted, apparently, to the months April—October. A fairly characteristic syndrome has been observed. The usual history is that of a normal delivery of a healthy child which does well for the first week and then, without any definite signs or symptoms, appears not to be thriving.

This indefinite illness continues for about a week, with progressive loss of condition, and ends with the death of the child, definite signs and symptoms of bronchopneumonia sometimes appearing in the last 24 or 48 hours. Sulphonamides and penicillin have proved ineffectual and numerous bacteriological examinations of the hospital staff and of material from the sick children have failed to indicate any causal organism.

Autopsy has been obtained in two of the children and reveals the site of the lesions to be mainly, if not exclusively, in the lungs. In both cases both lungs were diffusely and extensively studded with bronchopneumonic nodules of varying sizes and grey, or yellowish-grey in colour. The chief feature noted in paraffin sections was the almost complete absence of polymorphs from the pneumonic consolidations, all the cells being mononuclears and macrophages. Smears and sections from the consolidated areas revealed no organisms when stained by appropriate methods and cultures made from them at autopsy remained sterile. Two guinea-pigs, inoculated intraperitoneally with an emulsion of consolidated lung tissue from one case, made under aseptic conditions, died in 24 hours. No organisms were recovered from their peritoneum, there was no peritonitis, and further passages were not made. Other animals, including guinea-pigs inoculated intraperitoneally from the second case, rabbits and mice inoculated intraperitoneally and mice inoculated intracerebrally from both cases remained well. The cause of the condition, therefore, remains obscure. Inhalation of amniotic fluid as a likely cause has been excluded as far as possible.

INVESTIGATIONS ON MALARIAL PARASITES OF BIRDS AND ANIMALS IN THE SOUTHERN SUDAN.

Reference has already been made to the work on malarial and other parasites being carried out in the Southern Sudan by members of the United States Naval Medical Research Unit No. 3, Cairo. Mr. Henry Hoogstraal, in charge of the Sudan Subsection, writes as follows:—

“ The United States Navy has a program of medical research which includes subjects of actual naval interest and of basic scientific interest. Since malaria is of such great military importance much emphasis is put on basic research on this disease and as part of this program the “ Sudan Substation ” of the Naval Medical Research Unit at Cairo has been established at Torit, Equatoria, to investigate the malarias of mammals, birds and lizards. This work is the outgrowth of the findings of last years group attached to the University of California expedition. The two members who accomplished this work in 1948 returned in September of this year and plan to remain about two years. They are being joined by other specialists and are constructing laboratories and living quarters in Torit. It is hoped to deter-

mine as much as possible concerning the field aspects of the severe malarias found in the Southern Sudan, to establish their vectors, and especially to find their exo-erythrocytic stages. Considerable success has already been achieved with *Plasmodium fallax*, found last year in gallinaceous birds at Torit. Work on other bird malarias and on the epidemiology of elephant shrew malaria is now in progress as well as a survey of local fauna for other interesting malarias. As soon as the rainy season starts the other phases of the work will be undertaken. A study of the local ticks is also in progress and all ecto-and endo-parasites taken are preserved for specialists, as well as the hosts for taxonomical study."

BLOOD.

During the year a series of bloods from northern Sudanese was collected from the specimens coming to the Laboratories and sent to Dr. A. E. Mourant, of the Ministry of Health Blood Group Reference Laboratory, London, for typing, with special reference to the Rh. factors. Dr. Mourant has carried out a detailed investigation of the genotypical constitution of these bloods and the results, which are of considerable interest will be published separately by him.

Preparations of red bone-marrow from Sudan camels have been sent to Professor J. B. Cleland of Adelaide for studies on erythropoiesis in connection with the unusual shape of the mature red cells in these animals—an interesting mutation which must have occurred about 100,000 years ago to appear in the alpaca, etc. of South America as well as in the camel.

PUBLICATIONS.

During the year numerous papers on medical and allied subjects relating to the Sudan have been published by the staff of the Laboratories and others, including past and present members of the Sudan Medical Service. Following the receipt of an official request sent to various government departments by the Editorial Secretary, a list of these papers has been compiled for publication in Sudan Notes and Records. It is anticipated that in the future regular bibliographies will be published in Sudan Notes and Records, including references to all papers on medical and allied subjects relating to the Sudan.

Summary of Routine Examinations

Kahn Tests	..	..	..	..	..	14,388
Widal Reactions	..	..	..	..	..	1,547
Weil-Felix Reactions	..	..	..	..	..	1
Heterophile Agglutination Tests (Paul-Bunnell)	..	..	..	..	..	3
Blood Cultures	..	..	..	..	..	809
Blood Films	..	..	..	..	..	1,057
Blood Counts (Total)	..	..	..	..	..	73
Cerebrospinal Fluids	..	..	..	..	..	100
Medico-Legal Tests (Blood and Seminal stains)	..	..	..	..	..	33
Bio-Chemical Tests	..	..	..	..	..	243
Autogenous Vaccines	..	..	..	..	..	1
Pathological Histology (including brains for rabies)	..	..	..	..	..	594
Faeces	..	..	..	..	..	2,119
Urines	..	..	..	..	..	1,571
Throat and Nasal Swabs for <i>C.diphtheriae</i>	Positive	..	..	..	..	160
" " " " "	Negative	..	..	..	..	2,456
Virulence Tests (<i>C. diphtheriae</i>)	..	..	..	..	..	1
Sputa <i>Myco. Tuberculosis</i>	Positive	..	..	..	..	22
" " " " "	Negative	..	..	..	..	107
Spleen Smears (Kala azar positive)	..	..	..	..	..	2
General Bacteriological Examinations	..	..	..	..	..	420
Water Tests	..	..	..	..	..	242
Total Examinations	..	..	..	..	..	25,949

Summary of Faeces Examinations

<i>Bact. dysenteriae</i> Flexner V.Z. series	..	..	52
<i>Bact. dysenteriae</i> Sonne	..	..	4
<i>Bact. shigae</i>	..	..	5
<i>Bact. ambiguum</i> (Schmitz)	..	..	2
<i>Bact. typhosum</i>	..	..	84
<i>Bact. paratyphosum</i> B.	..	..	2
<i>Entamoeba histolytica</i>	..	..	17
Ova present	..	..	15
Negative	..	..	1,938

Summary of Urine Examinations

<i>Bact. typhosum</i>	..	..	..	..	..	47
<i>Bact. paratyphosum</i>	B.	..	..	..	..	1
Ova present	..	..	..	..	..	2
Negative	..	..	..	..	..	1,521

Summary of Blood Films

Malaria :—

Benign Tertian	..	..	..	7
Subtertian	..	..	..	65
Negative	..	..	..	985

Summary of Widal Reactions.

<i>Bact. typhosum</i>	..	..	..	..	239
<i>Bact. paratyphosum A.</i>	..	..	..	..	4
<i>Bact. paratyphosum B.</i>	..	..	..	..	3
<i>Br. melitensis</i>	..	..	..	..	49
Negative	..	..	..	..	1,252

Summary of Blood Cultures.

<i>Bact. typhosum</i> isolated	..	..	..	73
<i>Bact. paratyphosum A.</i> isolated	..	..	..	7
<i>Bact. paratyphosum B.</i> isolated	..	..	..	1
<i>Br. melitensis</i> isolated	..	..	..	1
<i>Strep. pyogenes</i> isolated	..	..	..	9
Other organisms isolated	29
Negative	689

Summary of Weil-Felix Reactions.

Negative	1
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Summary of Heterophile Agglutination Tests.

Positive	1
Negative	2

Summary of Kahn Tests

Positive	..	..	..	..	..	4,328
Negative	..	..	..	..	..	10,060

Vaccines Issued During 1949.

T.A.B.	..	..	..	..	..	15,000 cc.
Anti-rabic	..	..	..	..	..	124,200 cc.
Cholera	..	..	..	..	..	17,000 cc.
Vaccine lymph	..	..	..	..	..	698,400 doses

THE WELLCOME CHEMICAL LABORATORIES.

DR. A. J. HENRY.

The Laboratories were moved during the year from the cramped accommodation which they had occupied in Shambat since 1940 to premises above Headquarters, Medical Services, where ample laboratory space is available and the valuable library is adequately housed.

763 samples were examined during the year compared with 677 in 1948 and 776 in 1947. About one third of the samples were directly or indirectly of a medical nature, but owing to the nature of many of them they account for substantially more than half of the total effort of the Laboratories. Much of the work of a research or semi-research nature is also closely related to medical problems.

The routine samples examined were classified as follows, the corresponding figures for 1948 being also given :—

TABLE 38.

	1949	1948
Waters	85	97
Foodstuffs	162	184
Medicolegal and miscellaneous drugs	100	120
Mineralogical	95	54
Miscellaneous	321	222

During the year one original paper and the Report of the Government Analyst for 1948 were published.

ROUTINE WORK.

Waters.

All but four of the samples submitted were received for examination for potability. The majority of these were from new bores opened up by the Geological Survey.

Foodstuffs.

Under this heading are included milks, examined for the Public Health Authorities, alcoholic beverages, grains and flours, butter fats and various vegetable oils examined for suitability for consumption and a variety of miscellaneous foods.

Medicolegal and Miscellaneous Drugs.

These are divided into pathological (23), toxicological (29) and miscellaneous drugs (48). Of the first group 21 were post mortem specimens associated with seven separate cases of suspected poisoning. There were no definite positive findings, but in one case traces of a blue fluorescent alkaloid, probably identical with that found on several previous occasions, were present.

The toxicological samples examined contained little of interest, and the only positive finding was opium.

The miscellaneous drugs include a wide range of samples, amongst which were several different sulpha drugs, cocaine hydrochloride, codeine phosphate and antry-pol. Fourteen of the samples were scrapings from mud walls for estimation of D.D.T. and gammexane. Examination of these left little doubt that extensive penetration of the insecticide into the walls occurs, with consequent reduction of effective concentration at the surface. This will be followed up in detail when opportunity occurs, as it is a point of great practical importance.

Mineralogical.

Included in this category are 30 samples of coal and 30 samples of white metals examined for the Railways, mineral oils, and a wide variety of minerals and building materials of various types.

Miscellaneous.

One hundred and sixteen of these were oil seeds and cakes, for most of which full analyses were required; thirty one were methylated spirit examined for the Customs; and hundred and nineteen were cases of spoilage, of which sixty nine were attributed to sea water; and a variety which includes soaps, abavit B, perfumes, etc.

INVESTIGATIONS.

To a considerable extent research work was interfered with by the transfer of the Laboratories from Shambat, but in spite of this substantial progress was made along several lines of investigation.

Courbonia virgata.

An attempt was made to determine the nature of the bases other than tetramine and di- and trimethylamine which previous work had shown to be present. Owing to the difficulty of decomposing the periodides of these bases, and to the high solubility of their salts in water this effort was only partially successful. However, one of the bases present was successfully isolated in pure form as a crystalline periodide which has since been identified by Dr. H. King of the National Institute for Medical Research, Hampstead, as *laevo-stachydrin* ethyl ester. More recently two crystalline compounds have been isolated in pure form from the husks of *C. virgata* seeds which have been named Virgatin I and Virgatin II. The structures of these compounds have not yet been elucidated, but there seems little doubt that they are betaines in nature. From the root of *C. virgata* a salt of tetramine was isolated which contains an acid, not yet identified, the silver salt of which is, most unexpectedly, excessively soluble in water.

Capparis tomentosa.

This plant is of the same family (Capparidaceae) as *Courbonia virgata*, and has a reputation for being toxic to camels. It has been shown to be free from tetramine and volatile bases, but there are undoubtedly other bases, probably of a quaternary or betaine nature present which, however, have not yet been isolated in pure form.

Sudan Seed Oils.

The seeds of *Ammi visnaga*, used extensively in Egypt, as a diuretic, have been examined in detail. Solvent extraction of the seeds yields the seed oil proper plus the physiologically active principle, Khellin, which is a chromone. The fatty oil is typical of the family (Umbelliferae), to which this plant belongs, in that it contains major proportions of petroselenic acid.

In addition the oils from the kernels of *Parinarium curatellifolia*, *Capparis tomentosa* and *Courbonia virgata*, and from the husks of *C. virgata* have been fully characterised.

D. D. T. and Gammexane. During the investigation of the penetrability of preparations of these insecticides into the mud walls of which the majority of the Sudanese dwellings in this country are constructed, difficulties were experienced in the application of the usual analytical procedure on account of interference by the foreign organic matter extracted along with the insecticide. Modifications to the usual procedure have now been introduced which enable estimations of the insecticides to be carried out in such circumstances without difficulty.

2. MEDICAL ENTOMOLOGY.

MR. D. J. LEWIS.

Routine Work.

Samples of insecticides received from the Medical Stores were tested against *Aedes aegypti* and house flies. Enquiries about insecticides were answered, and much useful information about control measures was received in reports from the Colonial Insecticides Committee, the Inter-Departmental Insecticide Committees of the Agricultural Research Council, and the Tsetse fly and Trypanosomiasis Committee, London, from the East African Tsetse and Trypanosomiasis Research and Reclamation Organisation, Nairobi, and from the Bureau Permanent Inter-africain de la Tsetse et de la Trypanosomiase, Leopoldville.

Many specimens of insects were received and identified and some were sent to the British Museum of Natural History and the Commonwealth Institute of Entomology for further examination.

Monthly summaries of *Aedes aegypti* control returns were prepared as usual. The forms used have been simplified to save time and a list has been compiled of places on air routes where a very high standard of control is required. Control is carried out in other centres to an extent consistent with the staff available and the control of other mosquitoes.

Supplies of *Gambusia* were sent to Kordofan where they have proved to be effective in the absence of Nile species of fish.

As usual the Section owed much to the library and other facilities provided by the Research Division of the Ministry of Agriculture.

Training.

The Mosquito Control Officer and several other members of the Public Health staff were given instruction in the collection, identification and control of mosquitoes and other insects of medical importance.

Various specimens were prepared for instructional purposes.

Museum specimens.

The Modeller from the Graphic Museum spent a few weeks at Wad Medani making and painting scale models of adults and larvae of mosquitoes and *Simulium* for the Museum. The chief material used was wax which congealed at 65-71 °C. Owing to very slight bending of some of the models they were later copied in soft wood.

SANDFLIES.

Work on the classification of *Phlebotomus* was continued in co-operation with Dr. Kirk, a few days being spent at the British Museum.

Dr. W. H. R. Lumsden, of the Virus Research Institute, Uganda, visited the Section to study sandflies in the collection.

ANOPHELINE MOSQUITOES.

Wadi Halfa.

The *Anopheles gambiae* extermination area was visited and no anophelines found.

The Gezira.

Monthly searches for *Anopheles gambiae* were made in villages which had been sprayed with D.D.T. *A. Gambiae* was very scarce in Wad Medani in early 1949, probably owing to the larvicidal work which was re-organised in 1946.

Equatoria.

A report on mosquito control at Nzara was sent to the Province Medical Inspector.

CULICINE MOSQUITOES.

Species new to the Sudan were obtained by Mr. H. Hoogstraal, of the Chicago Natural History Museum, who has returned to Torit to continue his studies on insect vectors of disease.

CHIRONOMIDAE.

Chironomids are a serious pest in Khartoum and Wadi Halfa for two or three months in the year. They cause much annoyance by flying in large clouds and almost certainly produce asthma and other allergic conditions in some people.

Surveys from a steam launch showed that chironomid larvae breed on the bottom of the Blue Nile over an area of several hundred acres where the river widens and flows slowly past Khartoum. Some larvae were found in mud beneath flowing water seven metres (23 feet) deep, an observation which illustrates the difficulty of attacking this stage of the insects. In some countries chironomids breed more than 100 feet below the water surface.

Experiments were made on the effect of benzene hexachloride on larvae in the river. A suspension of coarse B.H.C. (2.5 per cent Gamma isomer) in water was sprayed in the shallow still water of Tuti Khor to give a bottom deposit of 0.005 gramme of the Gamma isomer per square metre. Many larvae were killed, but no success was evident when other parts of the river were sprayed. This was probably due to the effects of current, depth and the undulating nature of the bottom.

A preliminary test was made with insecticidal fog against adults.

The Senior Public Health Inspector experimented with light traps. Although these were not effective in reducing numbers materially it is hoped that larger traps with fluorescent lighting sited in the shelter of trees may prove successful.

SIMULIIDAE.

During a further survey in the south the known distribution of several species of *Simulium* was extended and several species new to the Sudan were found. Apart from *S. damnosum* and *S. griseicollis* none was found to attack man except possibly a large species at Laboni on the Southern slopes of the Acholi Hills. The river most infested with *S. damnosum* is the Sue; the fly is estimated to occur for 250 miles of its length, from Senango Faki to Wau and to extend many miles on each side during the rains.

A visit to the Fola Rapids near Nimule revealed no *S. damnosum* at all. This surprising result was attributed to a surge of water which occurs about twice a minute and apparently makes the banks unsuitable for breeding.

Further study of *S. damnosum* at Mvolo showed that by examining the halteres and certain other organs one can estimate the age of the flies. This finding is useful in making surveys to find the *Onchocerca volvulus* infection rate in the fly. Some 14 other parasites were found to parasitize *S. damnosum* in addition to *O. volvulus*. One was identified by Dr. Kirk as a *Crithidia*.

The existence of a peritrophic membrane in *S. damnosum* was established thanks to the kindness of Dr. V. B. Wigglesworth, F. R. S., who analysed one of these membranes at Cambridge. The membrane hinders the passage of microfilariae out of the midgut of the insect and usually protects it from heavy infection.

Dissections of *S. damnosum* showed, by xeno-diagnosis, several hitherto unknown areas of the disease. Flies infected with developing *Onchocerca* larvae were found over 20 miles from the Sue near one of its tributaries and 5 miles away in the absence of a tributary. It is likely that a broad belt of country, many miles wide, along the Sue and other rivers is infested with infected *Simulium*. It appears impossible to lay down a practicable safe distance from the river beyond which people can settle. To be out of range of infected fly they would often have to move into waterless areas or into *Simulium* range of the next river.

Dissection of *S. damnosum* at Mvolo in October revealed no infected flies and suggested that most or all the flies died young in the dry weather. It may be found that, contrary to previous ideas, the transmission season is in the rains and not in the fishing season when people assemble at the rivers.

With regard to control of *S. damnosum* in the Onchocerciasis areas the position is not hopeful. Owing to the great range of flight of the fly, extermination is probably out of the question. *S. damnosum* appears to breed between rapids as well as in them and it would be extremely expensive to provide sufficient staff, transport and equipment for repeated application of larvicides to hundreds of miles of river. The larvicide itself would be no mean item in rivers whose flow is measured in millions of tons a day, and fish would probably be destroyed. Although destruction of *S. damnosum* is probably far too expensive to be practicable the Sudan is fortunate in that the onchocerciasis areas lie almost entirely in country which is evidently unsuitable for economic development.

Dimethyl phthallate (sold in this country as Medical Services "Insect Repellent") can be extremely useful for protecting individuals against *S. damnosum*, but little

can be done for the general population. A considerable amount of information about the insect vector has been accumulated which should be useful in connection with siting of schools and other questions.

TSETSE FLIES.

The Medical Entomologist accompanied Professor P. A. Buxton, C.M.G., F.R.S., on a tour of the tsetse fly areas of Equatoria and Bahr El Ghazal Provinces. Professor Buxton then visited the Upper Nile Province and the tsetse area in the Koalib Hills of Kordofan.

An account was prepared, for publication, of the tsetse fly problem in the Sudan. It is based on all the published information of the past 45 years and contains a map of the known distribution of the seven Sudan species, *Glossina fuscipleurisa*, *G. fusca*, *G. longipennis*, *G. palpalis*, *fuscipes*, *G. tachinoides*, *G. morsitans* and *G. pallidipes*. and about 130 references.

G. longipennis, last reported in 1913, was found on the River Kurum by the Veterinary Inspector of Equatoria.

The control of *G. palpalis* is at present under review. It seems likely that in the future sleeping sickness will be kept to its present low numbers mainly through medical surveys and treatment and that the fly control will be reduced to a minimum.

PUBLICATIONS.

The following papers have been published.

KIRK, R. and LEWIS, D. J. (1948). Taxonomy of the Ethiopian sandflies (*Phlebotomus*) III.—New species and records: alterations and additions to the Reys—Ann. trop. Med. Parasit., 42 pp. 322—333.

..... 1949). The susceptibility of *Phlebotomus* species to D.D.T...
J. trop. Med. Hyg. 52 pp. 223—225.

LEWIS, D. J. (1949). The distribution of Cimicidae (Hemiptera) in the Anglo-Egyptian Sudan.....Parasitology, 39 pp. 295—299.

..... (1949). The extermination of *Anopheles gambiae* in the Wadi Halfa area. Trans. R. Soc. trop. Med. Hyg. 42 pp. 393—402.

..... (1949). Early references to malaria near Dongola. Sudan Notes and Records, 29 pp. 218—220.

..... (1949). *Glossina tachinoides* in North-east Africa. Bull. ent. Res. 39, pp. 529—530.

..... (1949). Tracheal gills in some African culicine mosquitoes larvae, Proc. R. ent. Soc. Lond. (A) 24 pp. 60—66.

..... and KIRK, R. (1949). The Zoogeography of Ethiopian species of *Phlebotomus* Agassiz (Diptera, Psychodidae). Proc. R. ent. Soc. Lond. (A) 24, pp. 51—55.

The following publications did not emanate from this Section but are noted because they deal partly with medical entomology in the Sudan.

EDWARDS, J. C. (1949). *Aedes aegypti* and other mosquito control in Port Sudan.—J. R. San. Inst., 69, pp. 718—720.

PARROT, L. (1948). Notes sur les phlebotomes. LIX Phlebotomes du Soudan Anglo-egyptien, 2.....Arch. Inst. Pasteur Algerie, 26, pp. 259—276.

PRATT, E. P. DRYSDALE, A. D. and KIRK, R. (1949). Typhus fever in the Anglo-Egyptian Sudan. J. trop. Med. Hyg., 52, pp. 157—160.

SABROSKY, C. W. (1949). On the distribution and correct name of *Oscinis pallipes*, the swarming gnat of the Sudan. Bull. ent. Res. 40, pp. 61—62.

SOPER, S. L. (1948). Species sanitation as applied to the eradication of (a) an invading or (b) as indigenous species.....Proc. Fourth Internat. Congresses on Tropical Medicine and Malaria pp. 850—857. Washington, D.C.

CHAPTER X.

METEOROLOGY.

Table 39 shows the recorded rainfall in the Provinces of the Sudan. Stations at which readings are taken are distributed widely throughout each Province and cover most of the area of the Province.

TABLE 39

PROVINCE	No. of Stations	Mean rainfall m.m.	Highest recorded m.m.	Lowest recorded m.m.
Bahr El Ghazal	15	1,010	1,472	684
Blue Nile	35	301	886	108
Darfur	15	431	827	137
Equatoria	28	1,232	2,774	603
Kassala	35	249	845	5
Khartoum	6	61	205	26
Kordofan	27	454	822	39
Northern	15	28	86	0
Upper Nile	19	878	1,484	332

TABLE I.

OUT-PATIENTS.
NEW CASES BY DISEASES.
AND
TOTAL ATTENDANCES.

DISEASE	BAHR EL GHAZAL	BLUE NILE	DARFUR	EQUATORIA	KASSALA	KHARTOUM	KORDOFAN	NORTHERN	UPPER NILE	TOTAL
1. T.B. Pulmonary ..	99	626	52	144	428	356	142	310	135	2,292
2. T.B. Non-Pulmonary ..	34	384	31	46	327	333	113	121	81	1,470
3. Syphilis ..	5,220	19,656	20,379	6,868	9,997	5,053	22,275	4,560	16,409	110,417
4. Gonorrhoea ..	1,197	6,155	2,265	2,543	4,878	3,415	4,301	1,144	1,266	27,464
5. Soft Sore ..	34	1,143	287	276	466	537	252	45	20	3,060
6. Trachoma ..	423	46,739	9,259	232	12,995	64,129	9,860	39,615	1,307	184,559
7. All Other Eye diseases	6,332	113,688	17,499	36,386	53,130	76,357	85,753	55,544	23,057	467,746
8. Ear ..	2,538	23,959	5,649	6,348	12,514	9,213	18,915	12,495	3,579	95,210
9. Skin ..	3,316	19,833	11,308	13,561	8,472	8,008	18,333	6,997	5,648	95,476
10. Wounds and other injuries ..	24,603	151,920	42,067	96,919	118,209	77,333	89,861	64,521	27,083	692,566
11. Tumours Malignant ..	6	102	24	13	31	81	121	60	18	456
12. Tumours Non-Malignant ..	8	3,039	49	39	243	184	371	467	32	4,432
13. Gynaecological ..	42	1,624	117	33	1,057	1,609	1,020	827	171	6,500
14. Confinements ..	82	378	74	29	149	2,304	246	144	75	3,481
15. Poisoning ..	—	39	96	70	21	58	131	211	21	647
16. Ancylostomiasis ..	1,758	117	318	4,951	9	12	33	335	42	7,575
17. Bilharziasis ..	417	6,262	2,028	1,913	567	753	5,522	3,058	117	20,637
18. Blackwater Fever ..	—	1	—	1	—	—	—	—	—	3
19. Dysentery, Amoebic ..	650	10,650	3,059	738	4,022	4,042	4,964	3,996	1,265	33,386
20. Dysentery, Bacillary ..	256	3,263	13	140	491	510	156	144	417	5,390
21. Filariasis ..	26	3	—	438	—	—	9	—	5	481
22. Malaria diseases ..	1	233	17	—	49	167	51	93	3	614
23. Malaria ..	6,990	82,375	10,566	13,900	21,238	7,076	44,097	13,251	19,733	219,226
24. Leishmaniasis ..	—	129	2	80	262	8	9	1	32	523
25. Trypanosomiasis ..	—	—	—	34	—	—	—	—	—	34
26. Yaws ..	7,965	—	—	14,916	—	2	—	—	—	28,778
27. Heat Stroke ..	—	—	—	—	7	1	—	5	—	13
28. Dracontiasis ..	607	84	17	2,296	66	10	343	58	243	3,724
29. Tropical Ulcer ..	6,738	3,208	818	10,239	803	45	5,893	22	5,542	33,308
30. Anthrax ..	—	—	—	—	2	1	—	—	—	3
31. Cerebrospinal Meningitis ..	127	42	12	121	12	19	15	5	—	353
32. Chickenpox ..	91	1,443	425	257	737	573	701	976	471	5,674
33. Dengue ..	—	—	—	—	—	—	—	—	—	—
34. Diphtheria ..	—	62	5	1	34	109	27	26	—	264
35. Enteric Fever ..	—	107	19	25	22	65	4	50	19	311
36. Erysipelas ..	—	6	1	—	—	7	3	1	1	19
37. Gastro Enteritis of Children ..	25	3,513	223	76	1,399	9,294	651	710	2,179	18,070
38. Influenza ..	3	4,081	1,443	658	2,899	3,417	1,188	3,980	148	17,817
39. Leprosy ..	13	30	26	452	38	30	48	19	19	675
40. Undulant Fever ..	—	11	5	6	12	5	4	7	2	52
41. Measles ..	3	2,351	478	276	608	841	1,427	266	467	6,717
42. Mumps ..	—	1,467	269	33	117	743	501	711	54	3,895
43. Pellegra ..	—	—	—	—	—	2	—	1	—	3
44. Puerperal Fever ..	—	55	4	—	5	53	37	20	2	176
45. Phlebotomus Fever ..	—	20	—	—	—	7	—	14	—	41
46. Pneumonia ..	589	6,141	874	1,117	2,122	3,397	1,195	1,729	878	18,042
47. Rabies ..	2	242	1	—	4	—	5	12	—	266
48. Relapsing Fever ..	—	128	173	—	56	3	16	—	—	376
49. Acute Rheumatism ..	11	90	13	193	18	205	75	712	1	1,318
50. Smallpox ..	9	41	132	—	—	1	25	—	38	246
51. Tetanus ..	14	33	2	6	7	11	17	4	6	100
52. Whooping Cough ..	1	1,160	56	137	1,447	479	410	1,523	116	5,329
53. Circulatory System ..	145	9,505	336	1,734	12,151	4,972	3,757	5,128	418	38,146
54. Respiratory System ..	9,717	113,745	21,431	62,236	69,838	67,128	65,954	50,609	14,278	474,936
55. Alimentary System ..	6,967	130,562	35,588	46,421	76,276	72,023	86,243	68,886	16,108	539,074
56. Genito - Urinary System ..	639	13,947	5,313	249	4,266	7,883	7,491	6,791	732	47,311
57. Nervous System ..	52	7,141	130	35	248	747	1,499	2,997	185	13,034
58. Scurvy ..	3	308	2	15	163	33	47	1	1	573
59. Diabetes ..	4	87	24	2	66	228	71	261	3	746
60. Fever of uncertain origin ..	—	—	—	—	—	—	—	—	—	—
61. All other diseases ..	1,132	26,410	3,121	11,649	16,770	18,516	6,644	13,560	1,251	99,053
	7,242	99,309	23,708	50,827	42,244	45,917	47,265	46,908	18,008	381,428
Total New Cases ..	95,931	917,647	219,808	389,678	481,993	498,355	538,091	414,231	167,780	3,723,514
ATTENDANCES : MEN ..	126,387	791,704	271,352	396,905	582,138	578,615	572,194	400,495	157,476	3,877,266
WOMEN ..	55,269	453,816	136,316	178,661	183,050	419,953	437,710	318,556	112,670	2,296,001
CHILDREN ..	59,596	788,450	224,953	220,641	371,995	542,637	663,147	619,049	163,876	3,654,344
Total Attendances ..	241,252	2,033,970	632,621	796,207	1,137,183	1,541,205	1,673,051	1,338,100	434,022	9,827,611
MISSIONS ..	—	—	—	139,615	—	36,609	83,242	—	99,591	359,057
Grand Total ..	241,252	2,033,970	632,621	935,822	1,137,183	1,577,814	1,756,293	1,338,100	533,613	10,186,668

TABLE II.
SUDAN : 1949.
ADMISSIONS AND DEATHS BY DISEASES.

DISEASES	BAHR-EL-GHAZAL		BLUE NILE		DARFUR		EQUATORIA		KASSALA		KHARTOUM		KORDOFAN		NORTHERN		UPPER NILE		TOTAL		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
1. T. B. Pulmonary ..	61	15	344	40	39	14	109	8	226	52	182	83	67	18	171	19	73	12	1,272	261	1
2. T. B. Non-Pulmonary ..	30	3	182	10	29	2	41	2	103	15	131	16	56	4	85	7	44	—	701	59	2
3. Syphilis ..	662	5	759	6	4,971	18	3,520	8	520	2	244	4	1,346	9	331	7	1,372	3	13,725	62	3
4. Gonorrhoea ..	920	—	676	2	758	2	1,327	1	1,087	—	219	—	688	2	213	—	153	—	6,041	7	4
5. Soft Sore ..	15	—	37	—	77	—	14	—	45	—	85	—	25	—	4	—	11	—	313	—	5
6. Trachoma ..	2	—	51	—	100	—	14	—	25	—	34	—	107	—	117	—	108	—	558	—	6
7. All other Eye diseases ..	167	1	389	—	355	—	601	1	259	1	1,228	—	306	1	505	—	1,445	—	5,255	4	7
8. Ear ..	54	—	77	5	66	—	216	1	47	1	38	—	63	—	48	1	35	—	644	8	8
9. Skin ..	357	1	316	3	256	1	300	2	149	—	202	—	318	2	190	—	110	—	2,198	9	9
10. Wounds and other injuries ..	1,959	21	3,754	50	2,888	40	4,068	47	1,764	35	1,500	28	2,958	72	2,086	18	1,163	14	22,140	325	10
11. Tumours Malignant ..	6	2	56	12	23	1	9	2	21	3	68	6	44	6	29	5	10	1	266	38	11
12. Tumours Non-Malignant ..	7	5	110	—	35	1	38	2	71	—	29	—	52	1	45	—	19	—	406	9	12
13. Gynaecological ..	25	—	933	4	112	1	29	—	331	—	683	8	287	7	258	6	52	—	2,710	26	13
14. Confinements ..	82	2	372	24	74	2	135	5	122	1	585	10	178	9	135	4	46	1	1,729	58	14
15. Poisoning ..	—	—	22	1	45	3	22	8	7	—	49	2	85	8	24	3	1	1	255	26	15
16. Ancylostomiasis ..	898	29	21	3	96	4	2,659	20	7	—	7	—	4	—	87	—	23	—	3,802	56	16
17. Bilharziasis ..	191	3	475	24	112	—	1,285	3	73	4	61	—	151	2	351	3	17	—	2,716	39	17
18. Blackwater Fever ..	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	2	—	18
19. Dysentery, Amœbic ..	209	8	406	12	919	21	424	10	428	16	304	5	446	15	245	3	200	7	3,581	97	19
20. Dysentery, Bacillary ..	44	—	100	5	13	—	24	—	109	1	216	—	82	9	49	—	48	6	685	21	20
21. Filariasis ..	20	—	3	—	—	—	266	—	—	—	—	—	1	—	—	—	1	—	291	—	21
22. Madura disease ..	1	—	144	—	20	—	—	—	27	—	63	—	26	—	61	1	2	—	344	1	22
23. Malaria ..	1,687	16	2,478	43	969	11	3,259	22	1,697	53	878	14	1,964	22	1,028	13	400	16	14,360	210	23
24. Leishmaniasis ..	—	—	129	19	2	—	80	2	262	54	8	1	9	3	1	—	32	5	523	84	24
25. Trypanosomiasis ..	—	—	—	—	—	—	33	1	—	—	—	—	—	—	—	—	—	—	33	1	25
26. Yaws ..	641	1	—	—	—	—	2,118	1	—	—	—	—	—	—	—	—	258	1	3,017	3	26
27. Heat Stroke ..	—	—	—	—	—	—	—	—	7	1	1	—	—	—	2	—	—	—	10	1	27
28. Dracontiasis ..	194	—	20	—	11	—	268	—	35	—	4	—	68	—	8	—	24	—	632	—	28
29. Tropical Ulcer ..	944	3	152	2	236	—	2,029	5	68	—	6	—	945	10	10	—	669	2	5,059	22	29
30. Anthrax ..	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	2	—	30
31. Cerebrospinal Meningitis ..	127	26	18	7	12	4	121	37	12	9	19	11	15	5	4	3	—	—	328	102	31
32. Chickenpox ..	90	—	268	—	423	—	195	—	508	—	87	—	431	—	115	—	155	—	2,272	—	32
33. Dengue ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33
34. Diphtheria ..	—	—	62	13	5	2	1	1	33	7	84	5	24	3	9	5	—	—	218	36	34
35. Enteric Fever ..	—	—	107	6	19	1	25	2	22	3	62	5	4	2	50	4	18	1	307	24	35
36. Erysipelas ..	—	—	6	—	—	—	—	—	7	—	3	—	3	—	1	—	1	—	18	—	36
37. Gastro Enteritis of Children ..	4	1	70	6	2	1	20	1	38	3	243	57	4	4	74	10	22	3	477	86	37
38. Influenza ..	3	—	21	—	197	1	124	1	68	—	75	—	50	—	133	—	6	—	677	2	38
39. Leprosy ..	10	—	25	1	21	3	70	2	16	7	2	1	7	—	2	—	4	—	157	14	39
40. Undulant Fever ..	—	—	11	—	—	—	6	—	12	—	5	—	4	1	1	—	2	—	41	1	40
41. Measles ..	1	—	123	—	188	—	124	—	80	—	105	—	1,149	14	21	3	49	—	1,840	17	41
42. Mumps ..	3	—	49	1	97	1	31	1	18	—	51	—	127	—	35	—	6	—	417	3	42
43. Pellagra ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	43
44. Puerperal Fever ..	—	—	47	2	4	—	—	—	2	—	4	—	5	1	8	2	1	—	71	5	44
45. Phlebotomus Fever ..	—	—	—	—	—	—	—	—	7	—	—	—	—	—	4	—	—	—	11	—	45
46. Pneumonia ..	435	28	1,769	113	557	51	1,027	66	1,051	58	1,259	49	651	62	798	34	258	24	7,805	485	46
47. Rabies ..	2	2	7	—	1	—	—	—	4	4	—	—	5	5	—	—	—	—	19	19	47
48. Relapsing Fever ..	—	—	68	1	173	—	—	—	56	2	3	—	16	—	—	—	—	—	316	3	48
49. Acute Rheumatism ..	9	—	27	—	12	—	21	—	15	—	62	—	45	—	269	1	—	—	460	1	49
50. Smallpox ..	9	—	38	5	132	8	—	—	—	—	1	—	25	—	—	—	38	—	243	13	50
51. Tetanus ..	14	3	31	14	2	—	9	5	7	1	8	7	17	12	4	3	7	4	99	49	51
52. Whooping Cough ..	1	—	11	—	30	1	60	2	23	1	62	1	12	—	42	6	10	2	251	13	52
53. Circulatory System ..	36	3	341	48	140	15	110	8	199	30	376	41	331	55	514	32	25	7	2,072	239	53
54. Respiratory System ..	324	4	764	35	321	7	724	6	613	13	716	8	1,010	24	589	7	167	4	5,228	108	54
55. Alimentary System ..	705	29	1,608	118	504	34	1,819	38	1,201	86	1,769	28	1,192	58	145	36	442	19	9,385	446	55
56. Genito-Urinary System ..	41	2	614	29	265	10	73	4	409	20	699	14	575	27	402	24	69	2	3,147	132	56
57. Nervous System ..	38	5	96	7	38	4	26	—	86	10	156	5	49	1	125	7	28	3	642	42	57
58. Scurvy ..	3	—	8	—	1	—	—	—	12	1	6	—	13	—	1	—	1	—	45	1	58
59. Diabetes ..	2	—	62	2	7	2	1	—	30	2	81	1	12	1	84	1	3	—	282	9	59
60. Fever of uncertain origin ..	79	1	494	48	351	23	371	3	384	30	362	8	103	9	441	12	161	11	2,746	145	60
61. All other diseases ..	2,314	15	1,049	34	661	8	3,576	11	1,252	22	1,326	41	1,047	54	1,046	6	1,036	2	13,307	193	61
Total ..	13,426	234	19,801	763	16,369	298	31,422	339	13,644	548	14,462	459	17,202	538	11,001	286	8,825	151	146,152	3,615	
MISSIONS ..	—	—	—	—	—	—	835	18	—	—	1,596	110	1,966	—	—	—	462	—	4,859	128	
Grand Total ..	13,426	234	19,801	762	16,369	298	32,257	357	13,644	548	16,058	569	19,168	538	11,001	286	9,287	151	151,011	3,743	